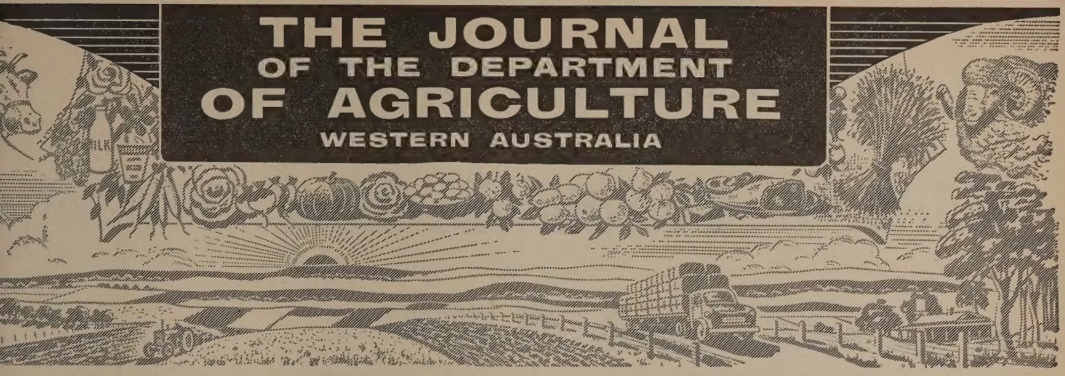
THE JOURNAL OF THE DEPARTMENT OF AGRICULTURE WESTERN AUSTRALIA



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Edited by
J. A. MALLETT

Articles which appear in the Journal may be reprinted, provided that both the Journal and the authors are acknowledged.

COVER PICTURE

The Old Mill, a long-neglected relic of Perth's pioneering days, has now been restored and forms the centre-piece of an interesting exhibit dealing with the early settlement of Western Australia.

In this Issue

	Page
A Survey of the Incidence of Lupinosis in Sheep — H. G. Neil, W. J. Toms and C. M. Ralph	565
The Fruit Industry in Other Lands—The Netherlands — F. Melville	575
Studies in the Mulga Pastoral Zone 2—Some Aspects of the Value of the Mulga Scrub .... D. G. Wilcox	581
Registered Stock Foods (Supplementary List)	587
Weeds of W.A.—Cape Tulip .... G. R. W. Meadly	593
Orchard Registrations	599
Lamb Marking ....I. K. Stott	601
Plant Diseases—Brown Spot of Passion Fruit — Plant Pathology Branch	611
What's Wrong with That Plant? .... Plant Pathology Branch	612
Insect Pests—Snails and Slugs .... C. F. H. Jenkins	615
Help Those Lambs to Live .... C. J. Spencer	621
Farm and Home—Setting the Table .... Helen M. Gloster	627
Honey Flora Calendar for August .... R. S. Coleman	630
Weed Control in Cereals .... G. R. W. Meadly	633
Trees of W.A. .... C. A. Gardner	643
Bracken Poisoning in Cattle .... P. B. Lewis	655

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A Survey of the

INCIDENCE OF "LUPINOSIS" IN SHEEP

in the

Dandaragan District in 1959

By H. G. NEIL, W. J. TOMS and C. M. RALPH

FOLLOWING widespread losses of sheep grazing on dry lupins, a survey of flock-owners' experience with the disease was made by the Department of Agriculture in one of the districts most affected.

The idea of a survey originated from discussions with the President, Mr. K. E. Jones, and several other members of the Dandaragan Pasture Improvement Group.

The information obtained from the survey has provided a valuable factual basis for the design of laboratory and field experiments.

Lupinosis has been described by Bennetts (1). It is a chronic disease characterised by a rapid loss of condition, dullness, loss of appetite, jaundice and a degree of sensitivity to light, accompanied by a rapid breakdown in liver tissue. The liver is usually pale in colour, very firm in texture, much smaller than normal, and with thin edges.

Deaths may occur within a week after sheep are placed on lupins, but usually do not occur for four to five weeks. Affected

Fig. 1—An area of lupins at the green stage

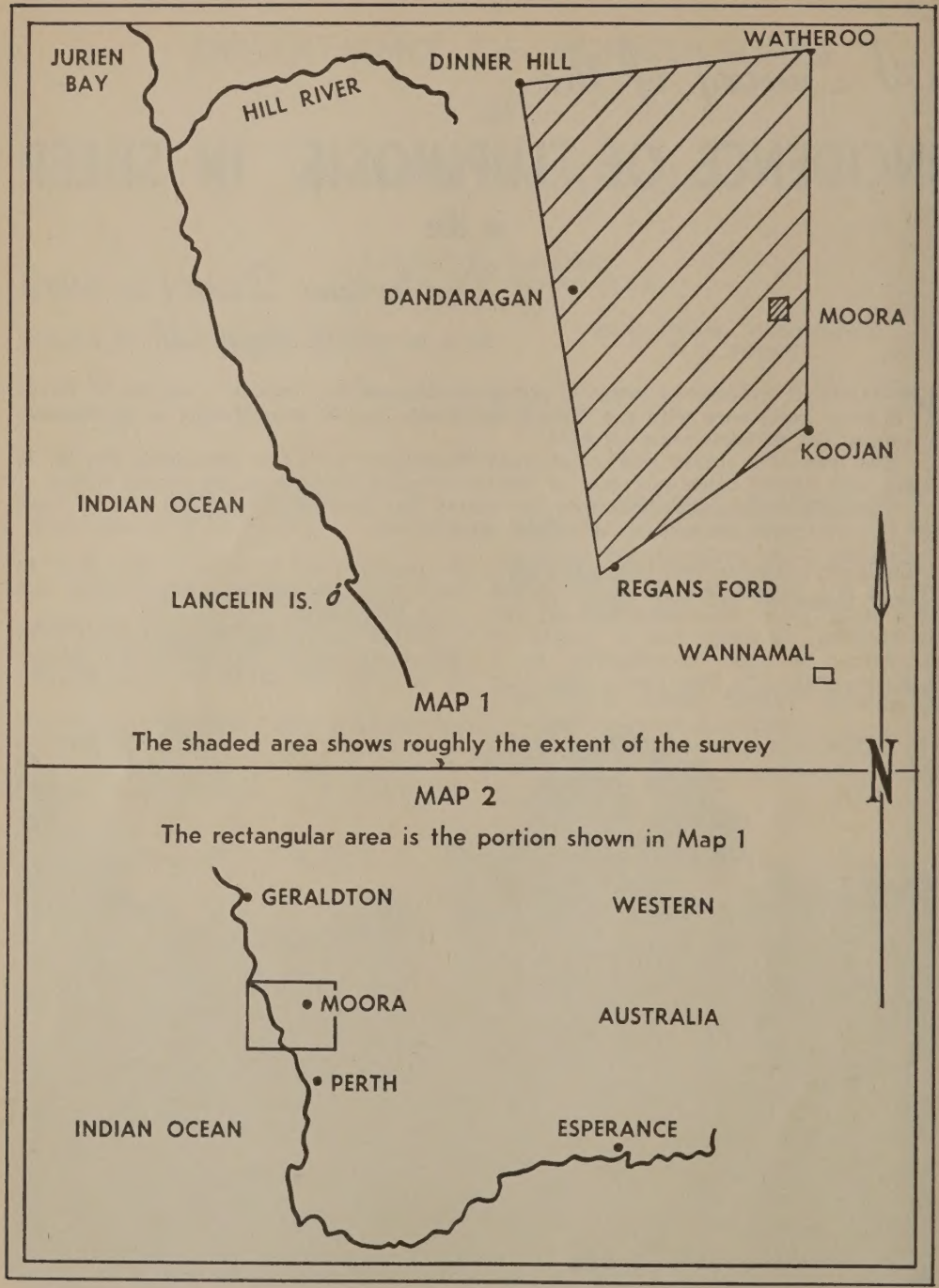

Fig. 2—Map showing area in which the survey was conducted

Fig. 3—A paddock of grazed dry lupins

sheep often recover, but do so over a period of some weeks.

Lupinosis must not be confused with lupin alkaloid poisoning. The latter is characterised by an excitement, especially if the sheep are disturbed, followed by a convulsive fit. This condition is rarely fatal, and the sheep usually recover in ten minutes or so, if undisturbed.

HISTORY OF SHEEP GRAZING PRACTICE IN THE DANDARAGAN DISTRICT

Three changes in grazing practice have occurred in the district since sheep were first grazed on lupins.

(1) In the early 1920s to the late 1930s sheep were purchased for fattening but were held for only short periods. Lupins were grown solely for summer grazing. Sheep fattened rapidly on the shed lupin seed. After the lupin pods had shed their seed in November there was a rapid turnover of stock on most farms in the district. Sheep were generally not kept longer than a month and were carried on lupin land at the rate of four to five sheep per acre.

(2) In the late 1930s the practice of rapid turnover of stock largely disappeared. This change was probably brought about by the reduced supply of suitable sheep from the outer wheat belt during the summer months. Sheep for grazing in the Dandaragan district were now purchased in spring and often were held until autumn before being sold.

(3) Recently, commencing in the early 1950s, many sheep owners in the district have sown subterranean clover and thereby have been able to carry a permanent flock of breeding stock as well as sheep bought for fattening over the summer period. The breeding sheep generally graze lupins for at least part of both the summer and winter periods. Because sheep are grazed among the lupins in winter there is possibly less non-lupin roughages available to the sheep bought for fattening over summer.

There were no reported cases of lupinosis prior to 1950 except for one case in the wheatbelt in 1948. Since 1950 there have been numerous reports of sheep affected by lupinosis. The fact that sheep are now able to graze on lupins over a longer period of the year may be a contributing factor to the occurrence of the disease.

THE SURVEY

Forty-one farms were visited in the Dandaragan district. The area covered is

roughly enclosed within the line joining Badgingarra, Watheroo, Regan's Ford and Koojan. (Maps 1 and 2).

The total acreage of properties visited amounted to 262,090, carrying 134,800 sheep and 4,398 head of cattle.

For the purpose of selecting properties for the survey, the holdings in the district were divided into two categories conveniently described as "new" and "old" properties. "New" properties were those that had been developed over the last few years. The "old" properties had been farmed for many years. They comprised the better soils of the Dandaragan area.

Fig. 4—A lupinosis-affected sheep. Such sheep tend to wander aimlessly until they encounter obstacles such as this fallen tree where they remain in a semi-comatose condition

Fifteen properties of the "new" category that grew lupins were selected at random. As many as possible of the "old" properties were also included. Because of their longer records "old" properties were considered more important. All properties included in the survey were visited by one or other of the authors and a questionnaire was filled in for each.

The number of properties reporting lupinosis was 22. Nineteen owners were confident that they had never experienced the disease. Two properties which had lupinosis while under different ownership in the early 1950's are now free of the disease. On one of these properties sheep now have access to other feed when grazing lupins. This is not a common practice in the district.

As almost half of the properties in the survey were not affected by lupinosis it suggested management methods might play a part in avoiding the disease.

SHEEP LOSSES

In the summer of 1958/59 deaths from lupinosis amounted to 3,707 sheep, or 3.5 per cent. of the sheep carried on affected properties. As a percentage of total stock carried on all properties in the survey, losses amounted to 2.5 per cent. Sheep deaths since 1950 totalled 7,370, or 0.7 per cent. of the total sheep carried during that period. These figures show that over half the losses since 1950 occurred during the 1958/59 summer. Records were often scanty and probably many owners could not identify lupinosis as the cause of deaths during the early occurrences of the disease.

Lupinosis was found to be a much more serious disease than was indicated by the numbers of deaths. Many owners either sold affected sheep as soon as they were aware of them losing condition, or retained them on the property but kept them off lupins, in the expectation that they would recover. Affected sheep sold for lower prices than did healthy animals.

PERCENTAGE RANGE OF DEATHS IN THE INDIVIDUAL FLOCKS

The incidence of losses in individual flocks further emphasises the seriousness of the disease and the financial strain that some owners have experienced.

Table 1

Percentage Deaths Occurring in Individual Flocks Affected by Lupinosis.

Number of flocks	Percentage of the flock that died
12	0–5
7	6–10
5	11–20
2	21–50
1	51–100

One owner lost 70 per cent. of his flock, two lost between 20 per cent. and 50 per cent., while five lost between 10 per cent. and 20 per cent. of the sheep in their individual flocks (see Table 1.)

In these flocks there was a high percentage of sheep that lost condition and were

unthrifty and unprofitable. In some cases all sheep were affected.

Low lambing percentages are another source of financial loss believed to be due to lupinosis. One affected property raised only 120 lambs from 1,000 ewes mated.

BREEDS, SEXES AND AGES OF SHEEP

Although sheep of all ages and breeds were affected, weaners and young sheep are evidently more susceptible to the disease than older animals and did not do well on lupins. Weaners are difficult to manage at any time and when grazing on dry lupins may not eat the seed as readily as older sheep do. Wethers and ewes are apparently affected alike.

TIME OF OCCURRENCE OF DEATHS

It was found that major losses occurred in the various flocks at different times during the summer period. This suggested that factors other than climate may be involved.

Table 2

Monthly Incidence of Major Losses Due to Lupinosis.

Date of first major losses	Number of properties reporting start of major losses
December	5
January	2
February	4
March	4
April	4
May	3

Summer rains, dews, hot weather and other climatic factors could not be identified as factors in the cause or onset of the disease during the summer months.

No connection between lupinosis and good or poor lupin years or years of higher winter rainfall was evident.

It was not possible to determine whether climatic or environmental conditions in winter could affect the occurrence of the disease.

TIME ELAPSING BEFORE FIRST DEATHS OCCUR

The time elapsing before deaths occurred after placing sheep on lupins, varied from one week to more than 16 weeks. Sixteen owners reported deaths within two months after placing sheep on lupins. The two owners reporting deaths within ten days had both kept the sheep in paddocks where there was no roughage other than lupins.

Table 3

Distribution of Properties According to Time of Occurrence of First Lupinosis Deaths.

Number of Properties	Time elapsing before deaths occurred (in weeks)
9	1–3
7	3–8
4	9–16
2	16

EFFECT OF BURNING DRY LUPIN ROUGHAGE

On one property, sheep which had been affected by lupinosis previously, were put into a paddock that had been poorly burnt. The fire had removed all the ground cover —pods, leaves and small stems—and had left standing the large stalks with some small stems attached. On another property a paddock was completely burnt out except for 10 acres of a very dense stand of lupins. In both cases stock introduced after burning the paddocks showed symptoms of the disease within ten days. This suggests that the disease can be caused by eating either the stalks and small stems, or the scorched seed.

It is unlikely that scorching of the seed would cause the disease as it is known that it occurs in unburnt paddocks. Bennetts (private communication) has reported that he was unable to induce the disease by feeding lupin seed. However, he has induced it by feeding lupin roughage. Dr. Gardiner (private communication) also reports that he has induced lupinosis by the feeding of lupin roughage. Therefore it seems likely that either the stalks or the small stems can cause lupinosis.

During October-November, 1959, sheep were observed grazing on lupin stands. In each paddock the sheep ate the small stems of the lupin plant in preference to mature brome grass roughage that was also present. There is no doubt that sheep find the small stems of the lupin plant palatable. From the evidence it appears very unlikely that sheep will contract lupinosis when grazing burnt paddocks containing only lupin seed.

PREVIOUS GRAZING EXPERIENCE ON LUPINS

Sheep are susceptible to the disease whether they have had previous grazing on lupins or not. No direct comparisons could be made on all affected properties because the owners were uncertain of the identity of the sheep that died. However, on four occasions, losses occurred with new sheep introduced to lupins, and on seven occasions with sheep that had access to lupins previously.

CUMULATIVE EFFECT OF GRAZING LUPINS

From the survey there was no direct evidence that sheep that had once recovered from the disease were then more susceptible to it. Sheep have been affected one year and the following year have been grazed on lupins without ill-effects. Both new sheep or sheep with previous experience with lupins may either die quickly or deaths may be spread over a lengthy period.

RESISTANCE TO LUPINOSIS

Two owners reported that only some sheep in each flock were affected while other owners were unable to make any comment as sheep were either sold or taken off lupins before deaths occurred. If there are some unaffected sheep in each flock, it could be because those sheep do not eat that part of the pasture causing the disease, or do so only sparingly. There was no direct evidence indicating that some sheep have an inherent resistance to the disease.

THE EFFECT OF FEED OTHER THAN LUPIN ROUGHAGE

Evidence from the survey suggests that sheep became affected when the only palatable roughage present is the lupin plant itself. If the lupin roughage is the cause of lupinosis, other palatable roughage may help to reduce the severity of the disease and provide a means whereby lupin paddocks can be used without danger or, alternatively, lupin plants could be removed completely by chaining and burning.

There are several sets of conditions which could lead to a large intake of lupin roughage, e.g.:

(1) Dense stands of lupins with very little else growing among them.
(2) High stocking rates.
(3) Stocking for long periods.
(4) Sparse stands of lupins with a dense cover of unpalatable mature brome grass.

No connection could be recognised between the onset of the disease and any single one of these factors. The disease occurred on thin and dense stands of lupins; in paddocks with high and low stocking intensity; and in paddocks where sheep had been left for short and long periods.

With high stocking rates, even if only for short periods, there is a grazing pressure on the sheep which may force them to eat lupin roughage. Mature brome grass (*Bromus* species) is particularly unpalatable in the early summer and is not consumed until the seeds are shed or removed by mechanical means. This grass occurs in dense and thin stands of lupins and can be dominant to such a degree that the only palatable roughage in the paddock is parts of the lupin plant. In general, it was found that at the time lupinosis occurred, one or more of the above factors had caused a shortage of palatable roughage other than lupins in the paddock.

PERCENTAGE OF SHEEP THAT RECOVER

The percentage recovery apparently depends on how badly the sheep are affected and the type of feed affected sheep are given.

When sheep are very sick there appears little chance of recovery. If sheep are moderately affected recovery should take place when removed to good feed other than lupins.

Grain feeding, even in liberal amounts, was reported to have little effect upon recovery. Sheep on a grain diet apparently still seek roughage and, if not removed from lupins, may be still prone to the disease.

DRENCHING

Sheep which are grazing on lupins or showing signs of lupinosis should not be drenched with either phenothiozine or bluestone-nicotine sulphate drenches. Many farmers reported rapid death of lupinosis affected sheep after drenching.

Fig. 5—Grazed lupins, with a sheep suffering from lupinosis

If sheep must be drenched it should be done before they have access to lupins.

ACREAGE OF LUPINS

In comparison with unaffected properties, those where lupinosis occurred had a greater:—

(1) percentage of used land under lupins;

(2) acreage of lupins;

(3) increase of lupins over the last 9 years (43,000 acres compared with only 7,000 acres);

(4) carrying capacity.

Table 4.

Lupinosis Incidence as Related to Usage of Lupins for Grazing and Rate of Stocking in Summer.

	Lupinosis Farms	Number Lupinosis Farms	Average
Lupins as percentage of used land	53	44	50
Lupins as percentage of cleared land	66	55	62
Lupins as percentage of total area	47	29	40
Bush grazing as percentage of land used	21	20	20
Sheep per acre in summer on cleared land basis	1·0	0·8	0·95
Sheep per acre in summer on used land basis (includes bush grazing)	0·8	0·6	0·76

The great increase in acreage of lupins on lupinosis affected properties over the last nine years may be related to the incidence of the disease.

VARIETY OF LUPINS AND AGE OF THE LUPIN STAND

Lupinosis occurs on both varieties, the W.A. Blue (*Lupinus digitatus* Forsk) and N.Z. Blue (*L. angustifolius Linn*) lupins, and on mixed sowings of the two varieties. The W.A. Blue was by far the most widely used variety.

Age of the lupin stand evidently has no bearing on the incidence of the disease. Lupinosis occurred on three occasions on new stands and on several occasions on old stands ranging in age from three to ten years or more.

FERTILISER APPLICATION

Fertiliser application appears to have no direct bearing on the disease. Properties where lupins have had no superphosphate reported lupinosis as did properties where superphosphate was used. Sheep on properties where copper and zinc had not been used were no less prone to lupinosis than sheep grazing land that had received these elements.

The average application of superphosphate to lupins on "lupinosis" properties (68 lb./ac.) was higher than on the unaffected properties (50 lb./ac.).

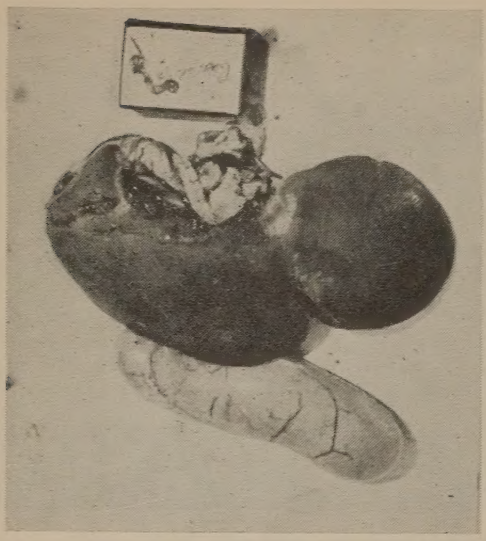

Fig. 6—The liver of a lupinosis-affected sheep. It is small, hard and fibrous. The enlarged gall-bladder is another common feature of this disease

GREEN LUPINS

It appears unlikely that young green lupins could cause "lupinosis" as it has been a practice for years to eat out lupin paddocks soon after germination.

Thirteen of the properties reported lupinosis when grazing only on dry lupins, and two when the plants were not quite mature. Five properties reported lupinosis when the young plants were very small. Sheep on these latter could have eaten left-over lupin roughage from the previous summer.

CAN THE DISEASE BE CORRECTED BY MANAGEMENT

The survey indicated that sheep owners in the Dandaragan district thought the disease could be avoided to some extent by reducing the amount of lupin roughage eaten by the sheep. This could be brought about by:—

(1) Sowing cereals in the lupin stand.

(2) Allowing stock access to lupin-free areas when grazing lupin paddocks.

(3) Burning lupin paddocks before grazing.

(4) Rotational grazing of "lupin" and "non lupin" paddocks (sheep to be shifted every seven days).

(5) Chaining pastures to cause grass seeds to shed, thereby making the mature grasses more palatable.

Owners considered that "set stocking" of lupin paddocks should be avoided.

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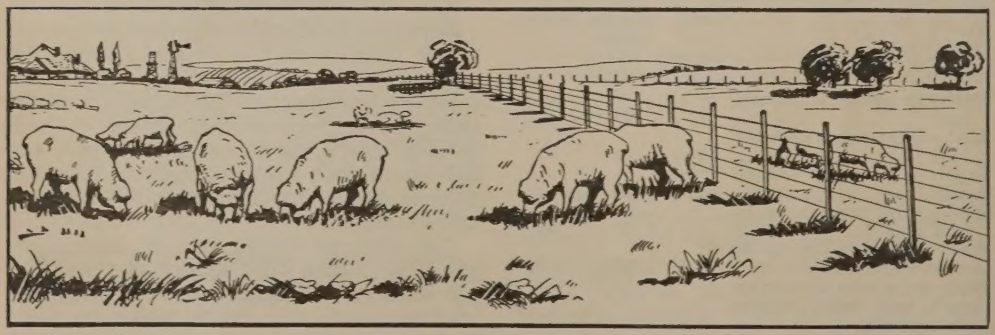
1. Bennetts, H. W., Journal of Agric. of W.A., Vol. 1, No. 1, 4th Series Jan., 1960, pp. 47-52.



The Fruit Industry IN OTHER LANDS

2—THE NETHERLANDS

By F. MELVILLE, B.Sc. (Agric.), Horticultural Adviser

DURING a week spent in Holland, visits were made to the International Agricultural Centre, Wageningen, the Fruit Research Station, Wilhelminadorp, the Virus Indexing Station, Emmeloord, the Glass House Research Station, Naaldwyk, and the fruit and flower auctions at Naaldwyk and Aalsmeer. Visits to commercial orchards were limited by time.

The International Agricultural Centre at Wageningen encompasses the State Agricultural University, a number of autonomous institutes and laboratories carrying out fundamental and applied research and also an advisory section of the Ministry of Agriculture.

Altogether over 60 separate institutes and laboratories are involved, covering a wide range of agricultural activities. Sections visited were the Plant Protection Service and the Institute of Phytopathological Research.

FRUIT GROWING IN THE NETHERLANDS

Fruit is grown on an area of approximately 160,000 acres with a production of more than 600,000 tons (approx. 30,000,000 bus.) per annum. Apples comprise approximately two-thirds, pears a quarter and the rest largely cherries and plums. Approximately 70 per cent. of the return for fresh and processed fruits comes from exports and amounts to about 120 million guilders (£15,000,000). Main export varieties are Golden Delicious, Cox's Orange Pippin and James Grieve apples and Conference, Beurre Alexander and Lucas pears. Grapes, peaches and plums grown under glass are exported in limited quantities but realise high prices. Apart from the United Kingdom, good markets are available in Belgium, Germany and Scandinavian countries.

Cool storage space for fruit in 1954 amounted to 90,000 tons, more than four times what it was in 1946.

THE PRODUCTION OF HORTICULTURAL CROPS UNDER GLASS

Vegetables, fruit and flowers are grown extensively under glass. In the main "Westland" and surrounding areas something like 6,000 acres of vegetables and 1,000 acres of fruit are under glass while further north, centred on Aalsmeer the majority of the 750 acres of glass house flower crops are produced.

At the Naaldwyk Experiment Station, grapes, peaches and plums were seen growing under glass. These are luxury crops and supply a very specific high-priced market. However, with the increased supplies of these fruits coming from early-maturing Mediterranean areas this market is gradually being lost and fruit growing under glass is declining in favour of vegetable crops, particularly tomatoes.

Grape-growing to produce early ripening fruit is an art requiring great skill. The natural habits of the vine can only be changed slowly over a number of years since the ultimate aim involves maturing the canes in late summer inducing an enforced dormancy and encouraging growth again during the winter to have grapes ready for picking in the spring. Yields are considerably reduced under these conditions.

Golden Champion grapes—a large white variety—were seen ready to harvest. The bunches were very well formed, berries of even size and remarkably clean and attractive. Hand thinning of bunches is essential and was stated to cost three pence per bunch. Bunches are limited to one per cane and some high yields are obtained. The main varieties grown are Black Alicante—a good storage variety which is often held in cold store for marketing in winter—and Black Hamburg (syn. Frankenthaler) which can be ripened very early. Although the grapes look particularly attractive they fail to ripen with high flavour or sugar content. An attempt was being made to grow Muscatels on an experimental scale but they failed to set well or ripen properly. Peaches seen included Lady Palmerston and various Japanese plums including Satsuma, Santa Rosa and Wickson were under test. Pollination is a problem under glass and European plums do not set satisfactorily. Mites tend to build up to serious proportions. Stone fruits are grown either as espaliers or as bush trees.

It is interesting to note the reversal of natural sequence of ripening of peaches and grapes. By careful manipulation it is possible to have grapes ready for harvest in March whereas peaches are not ready until May. One reason for this is the greater chilling period required by peaches than by grapes enabling earlier growth of the latter.

TOMATOES UNDER GLASS

In central west Holland, tomatoes are grown extensively under glass to supply European markets and local needs. Production amounts to about 150,000 tons per annum. Although the soil is regularly steam sterilised, continual trouble is experienced from the corky root disease which results in poor vigour and sometimes death. Recently a satisfactory control has been developed by grafting young tomato seedlings on to resistant roots. Apart from overcoming this disease the grafted plants are much more vigorous than normal seedlings.

Work has been in progress for very many years to develop virus-resistant varieties but with little real success owing to the difficulty of combining satisfactory fruit quality with disease resistance.

SPINDLE BUSH METHOD OF TRAINING APPLE TREES

The "Vrijespil" or spindle bush method of training apple trees is not new in Holland but has in recent years gained prominence using M IX as the stock. Over 90 per cent. of new plantings in the Zeeland area are being trained to this system. Trees are planted 6 ft. apart in the rows and 10 to 12 ft. between rows according to variety. The method consists of developing a spiral of lateral branches around a central trunk commencing at 24 to 30 in. from the ground. A central trunk is formed by maintaining a central leader which weakens out as the tree matures. All trees are staked, and lateral branches are tied down in summer to induce flower bud development. Pruning is aimed at producing a spreading rather pendulous habit and a careful balance must be maintained between the growth of the central leader and lateral branches. Fruit is normally produced in the third year and with limited pruning and the influence of the rootstock quite heavy crops are produced in succeeding years.

Five-year-old Jonathans trained by this method as replants in an old orchard were stated to be producing the equivalent of 300 bushels per acre. By the time the trees were fully developed, production was expected to be in the vicinity of 900 bushels per acre. Golden Delicious which is particularly well adapted to this system was expected to yield as well at Jonathans, with Cox a little more than half as well. Early cropping and reduced labour costs are the main objectives. The spindle bush has been used for many years for trees on more vigorous stocks. Trellising is considered uneconomical although a few growers are using this method.

Apple trees are, however, being trained on trellises as a means of inducing early fruiting for experimental purposes. The trees are trained usually on a two-wire vertical trellis and fruiting is induced, by tying down shoots and also summer pruning. Trees thus developed are used for checking fruit quality of scion varieties suspected of being infected with the Rough Skin virus and also for long term phytotoxic tests with fungicides and insecticides.

Fig. 8—The spindle bush method of training apple trees—Golden Delicious on M IX stock at Wilhelminadorp Research Station in the Netherlands

STUDY OF FACTORS IN NATURAL CONTROL OF SPIDER MITES

Preliminary work at the Wilhelminadorp Experimental Station has shown that the population on apple trees of red spider mite (*M. ulmi*) is related to the nutritional status of the tree. Under conditions of low nitrogen the level of mite infection is low and multiplication is restricted. As the nitrogen level rises and tree growth improves, so the mites increase. This work is at present a basic study of the problem with a view to finding means of reverting to a more natural means of control and restricting the use of modern insecticides and their detrimental effects on biological balance. However, the low nitrogen status also affects fruit yields.

SELECTION OF VIRUS-FREE APPLE AND PEAR ROOTSTOCKS AND SCIONS

At Emmeloord in the North East Polder the Plant Protection Service is indexing material from many sources with a view to selecting fruit tree stocks and scions free from known viruses. The double budding method is being used, with Lord Lambourne as indicator for rubberywood, mosaic and chat fruit, Bellde Boskoop for witch's broom, rough skin and rosette and Gravenstein for flat limb. Layer beds are being developed from tested rootstocks to provide material for distribution to nurserymen and tested scions are being grown to supply budwood.

PRODUCTION OF VIRUS-FREE PLANTS

At Wageningen, some unique work is in progress to produce virus-free plant material. Advantage is being taken of the virus-free condition of apical meristemmatic tissue. The work to date has been done with potatoes and carnations. The technique consists of taking a small section of meristemmatic tissue only a few cells thick and incubating on nutrient agar under controlled conditions until a small plant is produced. It is a very delicate operation but is proving practicable and plants in various stages of growth were seen. In a sense the principle of the method is related to Dr. Posnett's heat treatment work at East Malling. It is hoped that in time the technique can be

used in the production of virus-free fruit tree stocks and scions.

NEMATODE STUDIES

A survey of the susceptibility of 164 host plants to *Pratylenchus penetrane* carried out on six sites has produced some very interesting findings. The build-up of the soil nematode population was measured for each particular species or variety of plant during the growing season.

Legumes produced by far the greatest build-up—on an average about four times that of cereals and six times that of *Cruciferae*. One *Compositae* the French Marigold (*Tagetes* spp.) actually suppressed *Pratylenchus penetrane* causing a significant reduction in population. The practical effect of these findings were seen in the field. The continual succession of a susceptible crop resulted in serious suppression of growth and this was thought to be related to the increasing nematode population. Instances of this effect were seen with pear stocks and roses in nursery plots. The planting of one susceptible species following another resulted in seriously reduced vigour. On the other hand planting a susceptible crop after *Tagetes* gave improved growth. Instances were also seen where *Tagetes* planted among roses lacking vigour brought about a remarkable improvement in growth in one season. Further trials are still in progress. The effect of the continuous growing of leguminous cover crops in Western Australian orchards and the possible use of *Tagetes* as a soil ameliorant pose interesting problems.

Nematode Susceptibility

An interesting technique has been developed for studying the susceptibility of various plants to nematode attack and is being used to determine the resistance of new varieties of potatoes being bred for this purpose.

A section of wide polythene tube is filled with a very thin layer of nutrient agar containing a special cellulose preparation to enable the inclusion of masses of air-bubbles. Portion of the plant to be grown, or a seed, is inserted at the top before sealing. Water is introduced as required

Fig. 9—Apples trained on trellises at Emmeloord

through hypodermic needles. Root growth can be observed through the polythene and, after introducing the desired nematodes, their activities can be watched under a microscope. This method might have some application in testing apple rootstocks for nematode susceptibility.

Golden Nematode

The golden nematode was found in Holland in 1941 and is at present established in a number of places. Stringent measures are applied to limit the build-up of the nematode and also prevent its spread. The growing of potatoes or root crops on infected soil is prohibited in certain areas. In clean areas a three-year rotation for potatoes is enforced and potato growing is prohibited in the bulb belt. As a check on the pest, some 250,000 soil samples are taken each year and examined for the presence of the golden nematode cysts. By these means it is hoped not only to keep the pest in check but also reduce the area of infestation. This is particularly important in view of Holland's large export trade in horticultural produce. A potato variety resistant to golden nematode has now been produced and is being propagated for distribution within Holland.

SPRAY MATERIALS

Chemical analysis and field testing of all new insecticides, fungicides and herbicides is carried out as a pre-requisite of registration. Field trials have shown resistance of mites to the organic phosphates, systemics and also ovicides. The build up caused by DDT has been found to be due to increased egg laying rather than by a direct reduction of predators. Kelthane is one of the few materials retaining its effectiveness against mites.

DUTCH AUCTION

Locally-produced fruit, vegetables and other horticultural crops are sold by Dutch auction at Growers' Co-operative Marketing Centres. The produce is usually delivered by the grower and must comply with strict grading requirements. The Dutch auction system is based on a large clock-like arrangement located on the wall in front of the buyers. The perimeter is divided into 100 divisions representing prices and a hand is pivoted at the centre. The face of the clock contains a series of numbers corresponding with buyers' numbers and these can be illuminated individually. As each line is offered for sale an electrical device operated by the auctioneer causes the hand to swing round to the 100 mark and then retrace. Each buyer has a button on his desk which when pressed will stop the hand at the price indicated and at the same time illuminates the buyer's number on the clock. Thus there can be only one bid for each lot submitted. This system was developed by some of the early Dutch growers as a means of countering malpractices of buyers. It is very quick, and eliminates most of the noise associated with normal auctioning.

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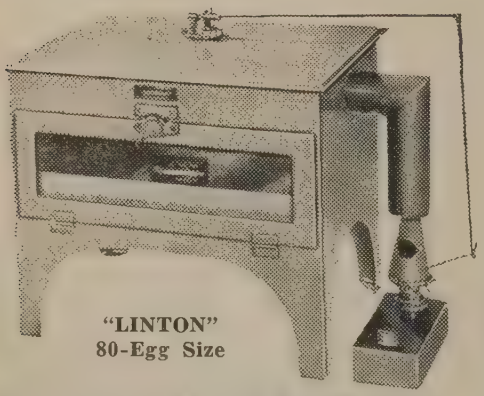

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Studies in the MULGA PASTORAL ZONE

2. SOME ASPECTS OF THE VALUE OF THE MULGA SCRUB

By D. G. WILCOX (B.Sc.Hons.), Adviser, North-West Branch

THE mulga pastoral zone is so named since most of its area is dominated by Mulga (Acacia aneura). The mulga is found associated with shrubs and grasses in almost all plant habitats. In its various forms it can associate with spinifex (Triodia basedowi), Wandarrie Grasses (Danthonia, Eragostis and Eriachne spp.) and with low shrubs on flood plains, hills and breakaways. It may even attempt to become established in salty communities, though this is never completely successful. The scene the area offers from its low hills is one of a succession of low undulations, occasionally scarred by creeks or breakaways and completely dominated by the dull green or blue grey overmantle of the mulga tree.

Exploitation of this region was rapid after 1890, and sheep numbers reached very high levels in the years prior to 1936. The high quality of the wool produced by the sheep was attributed to the high plane of nutrition provided for the sheep by the trees and shrubs of the area.

Mulga leaves can support sheep for considerable periods. Melville, in 1936 at Boolardy, fed sheep on mulga and found that poor sheep fed a ration of three pounds of fresh foliage a day gained an average of 12 lb. per head in nine weeks and produced good quality wool in this period. Analyses made from collections from all parts of the zone indicate that fresh foliage is capable of maintaining sheep and producing wool.

Cutting and lopping of the mulga scrub for sheep feed was practised on many stations during the severe drought of 1936 to 1941, and many sheep survived due to this practice. However, since 1941, in spite of several good seasons, sheep numbers have never returned to the levels they attained prior to this drought. Short periods of low rainfall have been sufficient to keep the sheep population at about 60 per cent. of its former level. It has been argued that the death of the mulga trees is responsible for this loss in carrying capacity and that a return of good seasons will enable regeneration to take place accompanied by an increase in sheep numbers.

However, apart from feeding trials with fresh foliage there is no evidence that mulga is useful to the grazing animal. A pure stand of mulga consists of trees 10 or more feet in height with the lowest foliated branches about four or five feet above ground level and quite out of reach of the sheep. The value of an undisturbed community must come from leaf and seed-pod fall and from the associated under-shrubs and grasses.

In this area of erratic and light rainfall, the most useful pasture is that which will produce edible forage with the smallest amount of rainfall. In a mulga association, trees, shrubs and grasses compete for rainfall at the one time. With light falls of rain, competition for moisture could be intense enough to preclude growth by any of the components of the association. Slatyer (private communication) at Alice Springs has shown that half the rainfall that falls on the canopy of a mulga tree is channelled down the trunk of the tree, where it is used to the exclusion of most other plants.

In a pastoral economy it has been assumed that the natural vegetation must be preserved. In nearly all other forms of agriculture, man has changed the native vegetation and introduced plants which

suit his needs better than those which nature has provided. On the American range, vast areas of sagebush have been removed and the land sown with suitable grasses. It is possible that similar practices could be introduced into the pastoral areas of this State.

However, there is no information available on the production of mulga stands under various seasonal conditions. Nor is there information on the production from shrubs and grasses in these associations. Nothing in fact upon which any sort of recommendation could be based, beyond the suggestion that the trees should be preserved chiefly because they are present in the natural state.

INITIAL EXPERIMENTS

This article will deal with two investigations which were commenced in 1956 and 1957. The first of these aimed at determining the effect of removal and partial removal of the tree cover upon the grass and herbage production of a mulga association. The second trial is an attempt to evaluate the contribution that mulga trees make to the diet of the sheep. This evaluation takes in both the leaf and seed fall from the trees in addition to the growth of grasses and herbage.

mulga. The trees were about 10 to 15 ft. high and the ground flora consisted of some perennial grasses, but was dominated by Windgrass (*Aristida arenaria*). The soil was fairly deep and in the original state the community appeared to have carried fairly dense perennial grasses.

Nine acres of this type of country were verminproof fenced in 1956 and on three acres all the trees were cut down and removed from the plot. The area of the canopies of the trees which were removed were measured before they were felled. On a further three acres within the enclosure one-third of the trees were removed and on the remaining three acres the trees were left undisturbed.

Cuts were made of the available green material on each of the three acre areas. These were separated on a species basis. Further cuts of the green grass and herbage have been made at four monthly intervals and the results are tabulated in the table below.

The table shows clearly that green production on the cleared area is much greater than that of the uncleared portion. Field observations have shown that response to rain by the ground flora on the cleared area is much more rapid than on the uncleared area and that green material

Table I

MEAN WEIGHT OF QUADRAT CUTS (GRAMMES)

	February, 1957	February, 1958	July, 1958	November, 1958	March, 1959	August, 1959	December, 1959
Mulga Removed	10·8	5·9	64·6	58·7	43·0	13·7	44·5
Mulga not Removed	25·8	2·4	34·8	26·8	11·0	53·5	22·2
⅓ Mulga Removed	22·3	1·7	26·2	18·5	17·9	53·8	20·5

Only a short time has elapsed since the commencement of these trials, but the results are indicative enough to provide a guide for future work and they have helped in the understanding of the value of the mulga scrub for the sheep.

(a) The Effect of Removal of Mulga Trees.

The area selected for this trial was dominated by the broad-leaf variety of

is available to the sheep for a much longer period following rain. This is illustrated in Fig. 1.

When the cuts were sorted at the beginning of the trial, Windgrass was the most important species present. Later cuts have shown that Broad Leaf Wandarrie (*Danthonia bipartita*) and Fine Wandarrie (*Eragrostis setifolia*) are gradually assuming dominance in the cleared area. At

the same time a remarkable increase in Blue bush (*Kochia tomentosa*) and Creeping Saltbush (*Rhagodia* spp.) has taken place.

Within the uncleared area the production of the ground flora has increased, but the pasture remains dominated by Windgrass.

Fig. 1 — Two photographs showing portions of the netted enclosure in the Mulga Removal Trial at Albion Downs. Note heavier growth of grasses where mulga has been removed

There has been some increase in perennial shrubs, but not to the same extent as in the cleared area.

This experiment is being duplicated on similar country, but the area is open to grazing by sheep and kangaroos.

(b) The Nutritive Value of a Mulga Association.

The area selected for this trial was very similar to that of the previous one. It is dominated by broad-leaf mulga and the soil is again quite deep. There are several under-shrubs, chiefly Poverty Bush (*Eremophila gilesii*) and it is in this that the area differs from the previous trial. The ground cover initially was Windgrass and Red Grass (*Eragrostis dielsii*), but since the area was fenced this ground flora has changed to Broad-Leaf and Fine Wan-

darrie grasses. This change is due essentially to the absence of stocking, since the effect is not apparent outside the plot fence.

The leaves and seeds of the trees are caught as they fall in steel pasture cages fitted with galvanised iron bottoms and with the sides covered with hessian and flywire. These cages are randomly scattered on the plot and collections made from them at four-monthly intervals. At the same time cuttings are made of the ground cover. The results of these cuttings are represented in the table below and in Fig. 2. The leaf and seed pod fall is analysed for protein, fibre and starch.

It can be seen that the maximum seed and leaf fall follows rain or more exactly follows a change from dry conditions to one of effective rainfall. Seed collections have always been separated from the leaf collections, but at no time have they exceeded an amount of ½ lb. per acre. The sharp increase in ground production in the last cutting period was entirely due to the change in the components of the grass population from annual to perennial grass.

SOME POSSIBLE IMPLICATIONS OF THESE TRIALS

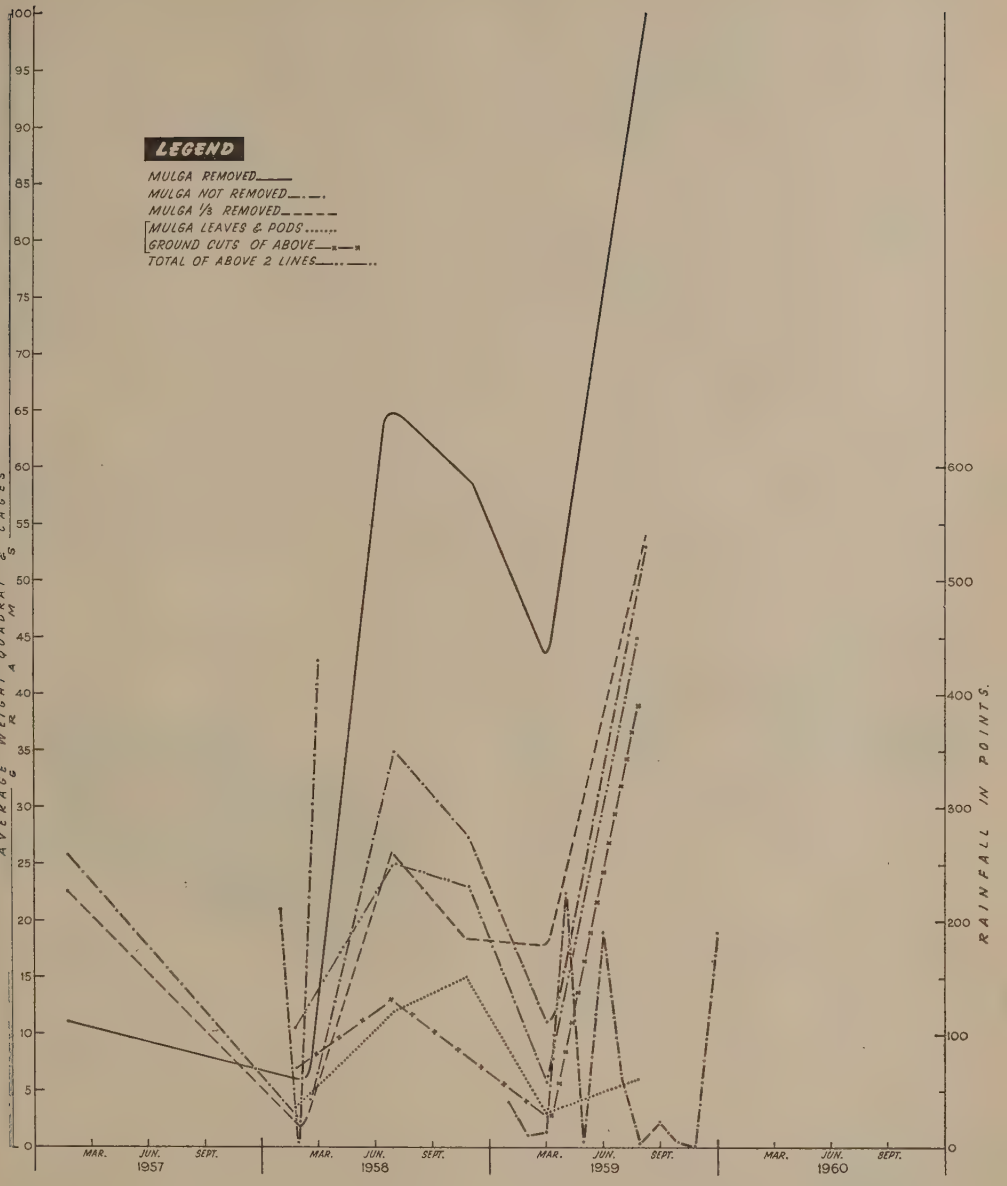
Reference to the tables shows that for the twelve-month period of June 1958 to June 1959, total production on the cleared area was over twice as much as that of the uncleared area. It is important to realise too, that this increased production is not so much due to an increase in the production of Windgrass, but is rather due to a change in the ground flora from annual to perennial grass. The response of small shrubs has further improved the pasture for the grazing animal.

Fig. 2—Portion of the area used in the Mulga Nutrition Trial, in which leaves and seeds falling from the trees were caught in steel pasture cages, and later weighed and analysed

Table II

MEAN WEIGHT LEAF COLLECTION AND QUADRAT CUTS (GRAMMES)

	February, 1958	July, 1958	November, 1958	March, 1959	August, 1959	December, 1959
Cages	3·5	12·0	15·0	3·0	6·0	14·6
Quadrats	7·0	13·0	8·0	3·0	39·0	13·9
Totals	12·5	25·0	23·0	6·0	45·0	28·5


LEGEND
MULGA REMOVED
MULGA NOT REMOVED
MULGA ⅓ REMOVED
MULGA LEAVES & PODS
GROUND CUTS OF ABOVE
TOTAL OF ABOVE 2 LINES
AVERAGE WEIGHT OF QUADRAT GMS CAGES
RAINFALL IN POINTS.
0
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
100
200
300
400
500
600
MAR.
JUN.
SEPT.
1957
1958
1959
1960

Maximum leaf and seed fall from mulga trees would appear to occur only after substantial rains following a period of aridity. In the twelve-month period, June 1958 to June 1959, the volume of seed and leaf fall was equivalent to 260 lb. per acre, and the total production from this association did not exceed 600 lb. The area of cleared mulga produced 1,400 lb. of edible material at the same time.

The seed fall for which the mulga associations are valued amounted to 2 lb. per acre in this year. This was in a period of high rainfall when seed formation should have reached a peak. During periods of stress when mulga leaves should provide some food useful to sheep, leaf fall was very low and the animals would have to rely upon some previous seasons drop.

It is likely that clearing of mulga trees could result in increased production from some types of country. It would probably be useful only in areas where soil conditions favour the growth of perennial grasses and shrubs. Under these conditions grasses shrubs and young mulga trees could provide an adequate ration for the sheep. Palatability of mulga does not appear to be influenced by its age, but is a characteristic possessed by the plant for its lifetime. Young mulga trees with shrubs could provide a valuable part of the diet of the animals in time of stress—a much more useful role than the mature trees play at present.

Some aspects of the role that shrubs play in these associations is being investigated at Koonmarra Station, while a large-scale clearing trial is being commenced at Barnong Station, Yalgoo. These trials should help in the formulation of some recommendations for the more successful exploitation of the mulga scrub.

ACKNOWLEDGMENTS

Messrs. R. S. Howard and J. Howard of Albion Downs Station, Wiluna, have helped in many ways by providing land and labour for these trials. Mr. J. G. Morrissey has assisted very ably in all phases of the field work.

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Registered Stock Foods . . .

(Supplementary List)

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis						
					Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	Percentage of other substances claimed to be of reputed Medicinal or Nutritive Value
					% (Min.)	% (Max.) (Min.)	% (Max.)	% (Max.) (Min.)	% (Max.) (Min.)	% (Max.) (Min.)	%
A.—Simple Foods											
1.—Meat Meals											
Liver Meal	277	Imperial	W. Angliss & Co. (Aust.) Pty. Ltd.	Animal livers and lungs	65·00	20·00 10·00	1·00	....	....	....	
2.—Meat and Bone Meals											
Protein Meat and Bone Meal	278	do.	do. do. do.	Animal meat, bones and livers	50·00	16·00 8·00	2·00	....	....	....	
B.—Compound Foods											
1.—Cattle Foods											
Dairy Food (High Energy)	266	P.P.	Picton Produce Pty. Ltd.	Oat meal, barley meal, bran, wheat meal, linseed, bone meal. calcium, salt and molasses	11·00	4·00 2·00	12·50	0·70 0·40	0·30 0·10	0·30 0·10	Trace Cobalt and Copper
2.—Calf Foods											
Calf Food	267	do.	do. do. do.	Oat meal, linseed meal, buttermilk powder, Apac Vit. D_3	12·50	5·00 3·00	7·50	0·50 0·20	0·50 0·20	0·40 0·20	Trace Cobalt and Copper
Baby Calf Milk	274	Westfarmers....	Westralian Farmers Co-op. Ltd.	Milk solids, dried brewers yeast, ground hulled oats, vitamins A, D_3, E, antibiotics	30·00	1·00	1·00	2·00 1·00	2·00 1·50	1·50 0·90	8 mill. I.U. Vit. A/ton 1·6 mill. I.U. Vit. D_3/ton 12,500 I.U. Vit. E/ton
3.—Sheep Foods											
Stud Breeders Sheep Cubes	272	do.	do. do. do.	Bran, clover meal, gristed grains, linseed meal, whale meal, peanut meal, urea, molasses, ground phosphate rock, ground limestone, salt, vitamins A and D_3, cobalt chloride, copper sulphate	20·00	2·00 1·50	10·00	1·00 0·50	1·00 0·50	1·50 1·00	Copper 30 ppm Cobalt 7 ppm 5·5 mill. I.U. Vit. A 1·1 mill. I.U. Vit. D_3
Summer Sheep Cubes....	273	do.	do. do. do.	Bran, clover meal, gristed grains, linseed meal, molasses, technical urea, dried whale solubles, ground limestone, ground phosphate rock, salt, copper sulphate, cobalt chloride	17·00	2·00 1·50	14·00	1·00 0·50	1·00 0·50	1·00 0·50	Copper 30 ppm Cobalt 7 ppm
Sheep Concentrate Pellets	275	do.	do. do. do.	Gristed barley. cotton seed meal, linseed meal, bran, urea, ground rock phosphate, pollard, ground limestone. salt, Vitamins A and D_3, cobalt chloride, copper sulphate	36·00	5·00 2·00	8·00	1·50 1·00	2·00 1·00	2·00 1·00	Copper 30 ppm Cobalt 7 ppm 11 mill. Vit. A I.U./ton 2·2 mill. Vit. D_3 I.U./ton

Stock Food	Applic. No.	Brand	By whom registered	Materials from which made	Registered Analysis						
					Crude Protein	Crude Fat	Crude Fibre	Sodium Chloride (NaCl)	Phosphoric Acid (P_2O_5)	Calcium (Ca)	Percentage of other substances claimed to be of reputed Medicinal or Nutritive Value
					% (Min.)	% (Max.) (Min.)	% (Max.)	% (Max.) (Min.)	% (Max.) (Min.)	% (Max.) (Min.)	%
4.—Poultry Foods											
Special Laying Pellets	248	Mayco	Maylands Milling Co. Pty. Ltd.	Bran, pollard, wheat meal, meat meal, bone meal, shellgrit and salt	17·00	4·00 3·50	5·00	1·00 0·75	3·00 2·50	3·50 3·00	
Laying Pellets	249	do.	do. do. do.	do. do. do.	16·00	4·00 3·50	5·00	1·00 0·75	3·00 2·50	3·50 3·00	
Poultry Protein Concentrate	254	Wesfarmers ..	Westralian Farmers Co-op. Ltd.	Meat meal, whale meal, oyster flour, salt, riboflavin, stabilised vitamins A and D_3, manganese sulphate	40·00	9·00 7·00	3·00	2·50 1·50	14·00 7·00	18·00 11·00	22,500 I.U. Vit. A/lb. 2,250 I.U. Vit. D_3/lb.
Laying Pellets, No. 1 ..	261	Millers	W. H. Milne & Co. Pty. Ltd.	Bran, pollard, wheat meal, whale-meal, gristed oats, barley, oyster flour, ground rock phosphate, lucerne meal, common salt, manganese sulphate	16·00	6·00 3·00	6·00	1·50 0·75	2·00 1·00	3·50 1·50	
16% Laying Pellets Vitamised A and D_3	263	do ..	do. do. do.	Bran, pollard, wheat meal. whale meal, gristed oats, barley, oyster flour, ground rock phosphate, lucerne meal, common salt, manganese sulphate	16·00	6·00 3·00	6·00	1·50 0·75	2·00 1·00	3·50 1·50	6·6 mill. I.U./ton Vit. A 1·98 mill. I.U./ton Vit. D_3
Laying Mash	264	P.P.	Picton Produce Pty. Ltd.	Bran, pollard, wheat meal, oat meal, meat and bone meal, ground lime, salt, Apac, Vitamin A	15·00	5·00 3·00	7·00	0·50 0·20	0·75 0·50	0·80 0·50	
Layers Mash	271	Jubilee	Jubilee Poultry Farm	Wheat meal, bran, oats, barley, whale meal, milk powder, yeast, bone meal, oyster flour, Apac	15·80	1·8 (Min.)	3·4	0·31 (Min.)	2·61 (Min.)	2·48 (Min.)	
5.—Chick Foods											
Pre Starter Mash	251	Wesfarmers..	Westralian Farmers Co-op. Ltd.	Bran, kibbled wheat, meat meal, buttermilk, skim milk, brewers yeast, terramycin, vitamins A and D_3, stabilised, manganese sulphate, riboflavin, nicarbazin	24·00	5·00 2·00	5·00	1·00 *Nil*	3·00 2·00	2·80 1·50	5,000 Vit. A I.U./lb. 550 Vit. D_3 I.U./lb. 0·0125% Nicarbazin
Pre-Starter Pellets ..	252	Red Comb ..	do. do. do.	Bran, wheat meal, meat meal, buttermilk, skim milk, brewers yeast, terramycin, vitamins A and D_3 stabilised, manganese sulphate, riboflavin, nicarbazin	24·00	5·00 2·00	5·00	1·00 *Nil*	3·00 2·00	2·80 1·50	5,000 I.U./lb. Vit. A 550 I.U./lb. Vit. D 0·0125% Nicarbazin
Pre-Starter Crumbles	253	Red Comb ..	do. do. do.	Bran, wheat meal, meat meal, buttermilk, skim milk, brewers yeast, terramycin, vitamins A and D_3 stabilised, manganese sulphate, riboflavin, nicarbazin	24·00	5·00 2·00	5·00	1·00 *Nil*	3·00 2·00	2·80 1·50	5,000 I.U./lb. Vit. A 550 I.U./lb. Vit. D_3 0·0125% Nicarbazin
Wexham Chick Mash ..	255	Wexham	do. do. do.	Bran, pollard, gristed oats, kibbled wheat, whale meal, buttermilk, meat meal, sterilised bone flour, lucerne meal, stabilised vitamins A and D_3	18·00	7·00 4·00	7·00	0·50 0·10	2·30 1·00	1·50 0·80	2,000 I.U./lb. Vit. A 180 I.U./lb Vit. D_3
Growers Pellets ..	262	Millers ..	W. H. Milne & Co. Pty. Ltd.	Bran, pollard, wheat meal, meat meal, whale meal, gristed oats and barley, oyster flour, common salt, manganese sulphate	15·00	6·00 3·00	6·00	1·50 0·75	2·00 1·00	3·50 1·50	4 mill. I.U./ton. Vit. A 1·2 mill. I.U./ton Vit D_3

Chick Starter	265	P.P.	Picton Produce Pty. Ltd	Bran, pollard, wheat meal, oat meal, meat and bone meal, buttermilk, Apac Vit. D_3	16·00	{4·00 / 2·50}	5·00	{0·50 / 0·20}	0·80 / 0·50	0·75 / 0·50	Vit. A and Vit. D
Growers Mash	269	Jubilee	Jubilee Poultry Farm	Wheat meal, bran, oats, whale-meal, yeast, bone meal, Apac	15·2	1·90 (Min.)	2·80	0·22 (Min.)	2·67 (Min.)	1·60 (Min.)	
Chick Starter	270	do.	do. do. do.	Wheat meal, bran, yeast, milk, whale meal, bone meal, Apac, oats	16·4	1·70 (Min.)	3·50	0·38 (Min.)	2·60 (Min.)	1·50 (Min.)	
6.—Pig Foods											
Pig Food	268	P.P.	Picton Produce Pty. Ltd.	Barley and oat meal, wheat meal, linseed meal, bone meal. buttermilk powder, ground lime, salt	15·00	{5·00 / 4·00}	7·00	{0·50 / 0·20}	0·60 / 0·40	0·60 / 0·50	
Sow and Weaner Meal	276	Wesfarmers .	Westralian Farmers Co-op. Ltd.	Bran, pollard, whale meal, gristed wheat, gristed barley, sterilised bone flour, salt, ground phosphate rock, vitamins A and D_3	18·00	{3·00 / 2·00}	6·00	{1·00 / 0·50}	2·50 / 1·50	2·00 / 1·00	6 mill. I.U./ton Vit. A 1·2 mill. I.U./ton Vit D_3

Stock Food	Applic. No.	Brand	By whom Registered	Materials from which made	Registered Analysis: Sodium Chloride ($NaCl$)	Phosphoric Acid (P_2O_5)	Lime (CaO)	Magnesia (MgO)	Iron (Fe)	Sulphur (S)	Iodine (I)	Copper (Cu)	Cobalt (Co)	Manganese (Mn)	Potassium (K)	Zinc (Zn)	Other
					% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	%
C.—Stock Licks																	
4.—Mixed Stock Licks																	
D.C. (New)	244	Bio	The Biological Institute of A/Asia Pty. Ltd.	Iron glycerophosphate, copper chloride, cobalt chloride, calcium glycerophosphate, ammonium molybdate, commercial hydrochloric acid, water	....	2·95	1·74	....	0·37	....	....	0·085	0·014	....	....	....	Molybdenum 0·03%
Mineral and Vitamin Powder for Pigs	245	do.	do. do.	Potassium nitrate, oil of aniseed, foenugreek alstonia powder, limonite, copper sulphate, cobalt sulphate, calcium carbonate, potassium iodide, liver meal, Vitamins A and D_3, riboflavin, bone flour	....	5·60	22·25	....	3·20	....	0·037	0·026	0·026	....	As Nitrate 13·4	....	Vit. A 44,500 I.U./lb. Vit. D_3 4,450 I.U./lb. Riboflavin 33 mg./lb.
Ovaltine for Fowls	246	do.	do. do.	Alstonia bark, ginger, foenugreek, ferrous sulphate, magnesium sulphate, potassium iodide, manganese sulphate, copper sulphate, cobalt chloride	....	....	....	7·30	5·87	....	0·05	0·40	0·03	$MnSo_4$ 2·19	....	....	
Vigomin	247	do.	do. do.	Malt flour, buttermilk powder, liver meal, charcoal, vitamin A (250.000 I.U.), vitamin D_3 (25.000 I.U.), sodium chloride, sulphur, ferrous sulphate, bone flour	1·25	30·00	25·00	....	0·75	1·90	....	....	....	....	....	....	Vit. A 250,000 I.U. Vit D_3 25,000 I.U.
Trace Element Stock Lick	250	Canterbury	Canterbury Stock Stock Feed Manufacturing & Distributing Co.	Phenothiazine. molasses, vitamin A and D_3, copper, cobalt, zinc, manganese, potassium, iodide, tricalos, iron sulphate, magnesium sulphate, meat meal, sulphur, salt. linseed meal, cod liver oil	24·00	12·00	18·00	As ($MgSO_4$) 1·00	As ($FeSO_4$) 2·00	1·50	Trace	Trace	Trace	Trace	....	Trace	Vit. A 125 units per gram Vit. D_3 22·5 units per gram Molasses 4%

STOCK FOODS—continued

Stock Food	Applic. No	Brand	By whom Registered	Materials from which made	Registered Analysis											
					Sodium Chloride ($NaCl$)	Phosphoric Acid (P_2O_5)	Lime (CaO)	Magnesia (MgO)	Iron (Fe)	Sulphur (S)	Iodine (I)	Copper (Cu)	Cobalt (Co)	Manganese (Mn)	Potassium (K)	Zinc (Zn)	Other
					% (Max.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	% (Min.)	%
Red Band New Vitamin Formula	256	Min-a-Vit	Min-a-Vit Pty. Ltd.	Bone dust (sterilised), talc, calcium carbonate, salt, molasses, copper sulphate, zinc sulphate, manganese sulphate, cobalt sulphate, iron oxide, potassium iodide, vitamins A, D_3, B_{12}, E	16·00	12·00	18·00	6·00	0·625	....	0·043	0·025	0·009	0·032	....	0·022	Vit. D_3 320 I.U./grm. Vit. A 9,200 I.U./oz. Vit. B_{12} 25 microgram per oz. Vit. E 8 I.U./oz.
Black Band New Vitamin Formula	257	do.	do. do.	Bone flour, calcium carbonate, manganese sulphate, iron oxide, potassium iodide, sodium chloride, cobalt, sulphate, copper sulphate, vitamins A, D_3, K_3, calcium pantothenate	15·00	27·00	40·00	....	0·077	....	0·030	0·0025	0·0020	0·42	....	....	Vit D_3 215 I.U./grm. Vit. A 1,090 I.U./grm. Vit. K_3 25 mg./lb.
Mineral Supplement for Cows	258	Hyco	Goldsbrough Mort & Co. Ltd.	Potassium chloride, magnesium oxide, zinc sulphate, manganese sulphate, copper sulphate, sodium molybdate, sodium borate, potassium iodide, iron sulphate, cobalt chloride	....	4·00	....	ppm 1,500	....	ppm as KI 200	ppm as ($FeSO_4$) 750	ppm as ($CuSO_4$) 2,500	ppm as ($CoCl_2$) 250	ppm as ($MnSO_4$) 1,500	As KCL 10·00	ppm as ($ZnSO_4$) 1,500	Molybdenum and Boron Trace
Mineral Supplement for Sheep and Cattle	259	Hytel	do. do.	Manganese sulphate, magnesium oxide, copper sulphate, zinc sulphate, cobalt chloride, potassium iodide, potassium chloride, iron sulphate, sodium borate, sodium molybdate	....	....	....	4·00	As ($FeSO_4$) 0·50	....	As KI 0·05	As ($CuSO_4$) 12·00	As ($CoCL_2$) 0·50	As ($MnSO_4$) 7·50	As KCL 20·00	As ($ZnSO_4$) 8·00	Trace Boron and Molybdenum
Mineral Supplement for Sheep and Cattle	260	Hytel 2	do. do.	do. do. do.	....	As $Ca_3(Po_4)_2$ 10·00	....	As ($MgSo_4$) 4·00	As ($FeSO_4$) ppm 1,000	....	As KI ppm 1,000	As ($CuSO_4$) 12·00	As ($CoCL_2$) 0·50	As ($MnSO_4$) 7·5	As KCL 15·00	As ($ZnSO_1$) 8·00	Trace Boron and Molydbenum
TriCalphos Hical	279	Terra	Terra Trading Co.	Lime, Mineral phosphate, mangesite, gypsum, copper sulphate, cobalt sulphate, manganese sulphate, zinc sulphate, sodium molybdate, sodium selenate, potassium iodide, aniseed oil	....	11·00	43·50	0·50	ppm 1,200	0·50	ppm 100	ppm 1,500	ppm 200	ppm 300	....	ppm 200	Selenium 30 ppm Molybdenum 150 ppm
TriCalphos HiPhos	280	do.	do. do.	Rock phosphate, gypsum, magnesite, copper sulphate, cobalt sulphate, manganese sulphate, zinc sulphate, sodium molybdate, sodium selenate, potassium iodide, aniseed oil	....	34·50	43·00	1·00	ppm 3,000	0 50	ppm 100	ppm 1,500	ppm 200	ppm 300	....	ppm 200	Selenium 30 ppm Molybdenum 150 ppm

ONE-LEAFED CAPE TULIP

[*Homeria Breyniana* (L.) Lewis]

Two species, the one depicted above and the Two-leaved Cape Tulip (*H. miniata* Sweet) are perennial weeds of major importance occurring over an extensive area in Western Australia. Besides reducing the carrying capacity and value of land they are poisonous to stock.

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The vacuuming process works automatically with outside air pressure, the two forces combining to exert enormous pressure to ensure complete compaction of the whole of the stack in around two hours, depending on the type of material.

The principle gives a very accurate control on compaction, and since compaction is the whole key to silage making Vacuum Fodder results in infinitely higher quality fodder without waste.

A stack of silage 25 ft. in diameter, 10 ft. high can contain up to 80 tons of feed and using the vacuum principle this 10 ft. high stack can be brought down to a consolidated height of around 4 ft. during the vacuuming process. You can actually see the stack being sucked down.

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THE STACK has been built and is ready for covering with the plastic vacuum dome. Note how the forming ring, which gives the stack its cylindrical shape, has climbed up the side of the stack.

HERE, a vacuum pump driven by a tractor is extracting the air from inside the "vacuum fodder" silage stack. The stack has begun to sink from the top as compaction of ensiled material takes place. This technique of making silage has been developed in Australia by Grasslands Farming Equipment. There is little loss of food value or waste in the process.

Permanent cover replaces vacuum making dome fully protects stack against waste by air and moisture prevention.

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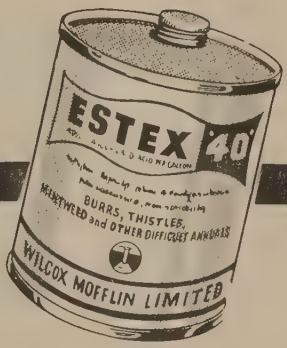

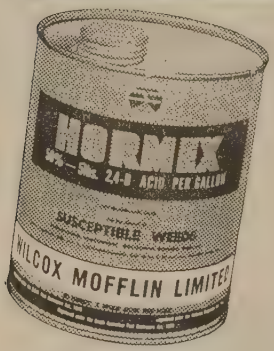

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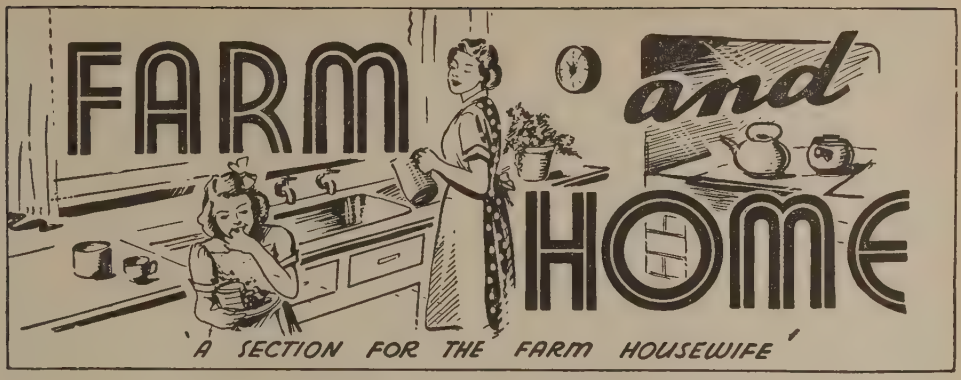

Setting the Table

By HELEN M. GLOSTER

IF we regard food as simply something that is necessary to maintain life, we are forced to the conclusion that basically there is very little difference between the delectable creations of a chef de cuisine and the scorched kangaroo and witchety-grubs enjoyed by the outback aborigines. This is so patently untrue that we are encouraged to delve deeper into the subject.

Almost since man has walked on two legs the partaking of food has occupied a prominent place in his social life. Even the most primitive tribes made feasting a feature of ceremonies dealing with religion, birth and death, the attainment of manhood and all the outstanding events of their existence.

As civilisation progressed we find mankind moving farther and farther from the "eat to live" principle. The meal-table became the centre of our family life and of our social existence in many cases. The preparation and serving of food became an art—its consumption became the source of keen enjoyment and an adjunct to entertainment, conversation, education and many of the finer things of life.

With improved methods of cooking—the creation of palate-pleasing dishes to bring refinements of eating pleasure—we realised that the appeal to the eye as well as the taste-buds was also important, and table-setting became an important prelude to a meal.

THE BASIC RULES

The tables themselves should be firm, and large enough to hold all the appointments and food without overcrowding. A "wobbly" table can cause embarrassment and detract from the pleasure of the meal. There should be ample room round the table for each person to sit comfortably—at least 24 in. for each person.

The table-cloth—whether it be for a dinner, luncheon, supper or afternoon tea—should be well-laundered and spotlessly clean. Cutlery, silverware, china and glassware should be bright and gleaming.

THE TABLE-CLOTH

For formal dinners, it is a good idea to place a "silence cloth" on the table, before laying the table-cloth proper. This is usually felt or woollen material—a well-laundered white blanket would serve—and its purpose is to protect the polished table surface and to deaden the sound of dishes being put down or removed.

KEEP THE FLORAL ARRANGEMENTS LOW—Lofty arrangements of flowers on the dining table may look delightful from a distance but they annoy diners who wish to see and converse with the people across the table. Here is an informal but very effective low level decoration—an arrangement of deep red roses in a large shell

It also gives a better appearance to the table-cloth and holds it firmly in position so that it does not tend to slip.

The table-cloth should be spread with the centre crease running down the exact centre of the table so that the overhang is even on all sides.

Individual place-mats are very effective on a highly-polished table. The large silence cloth cannot, of course, be used in this instance but smaller mats or cork mats to take the plates are necessary to protect the table surface.

Place-mats should be large enough to take the place-settings comfortably.

TABLE DECORATIONS

The hostess has ample scope to make a table attractive. The table-cloth—or individual place-mats if a highly-polished table is used—can present a pleasing background.

Dishes of food placed on the table before the meal may be attractively garnished or decorated. Table-napkins may be folded in novel designs. Candles in attractive holders can shed soft light on the table and its surroundings—and can be flattering to frocks and complexions.

Dishes of fruit and various flower arrangements can add to the enjoyment of a meal, but floral arrangements must be carefully planned.

Don't have flowers which obstruct the view of the diners and interfere with the flow of conversation. Choose low flower containers and arrangements which suit the occasion.

Don't use flowers with heavy, cloying perfumes or those which shed petals, leaves or pollen freely.

TABLE ARRANGEMENTS

Aim at a neat attractive appearance with uniform place-settings. Cutlery should be placed squarely with handles about one inch from the edge of the table, the prongs of the forks curving upward, the cutting edges of the knives facing inward and tumblers or wine-glasses with rims upward.

There should be sufficient space between the cutlery to accommodate the dinner-plate, and the individual covers or place-settings should be equally spaced one from the other.

For a dinner or other meal with several courses, the cutlery is arranged in the

ANOTHER LOW-LEVEL DESIGN—Deep lavender irises in the centre are surrounded by pink roses. Smaller pale pink roses and still paler spikes of gladioli give added length to the arrangement

order in which it will be used, commencing from the outside. The four main courses are usually soup, fish, the meat course, and a sweet. Even where extra courses such as an entree or an additional poultry course are included, many people do not provide extra cultery on the table but bring the extra knives, forks, etc., round with the plates. If desired, the dessert-spoon and fork may be placed above and across the plate position, instead of at the sides, inside the knife and fork set for the meat course.

Table-napkins should be folded and placed in the centre of the place-setting. A cube of bread or a small roll may be placed in the folds.

Tumblers or glasses should be placed immediately above the knives.

Containers for salt, pepper, mustard, sauces and similar condiments should be placed conveniently, and should be duplicated to save delays by passing them to and fro.

Butter-dishes, sugar-basins, etc., should be strategically placed and here again should be duplicated where necessary.

Where special containers are not available, sauces, pickles, etc., may be served in their original jars or bottles, camouflaged with small table-napkins folded round them. Bottles are usually placed on small plates or saucers.

The coffee or tea service is usually arranged on a side-table or conveniently-situated side-board or traymobile. Tea is not normally served at formal dinners, but is such a popular beverage in Australia that many people include it as an optional extra.

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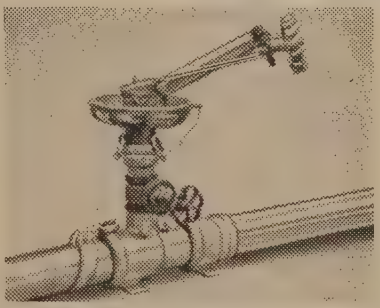

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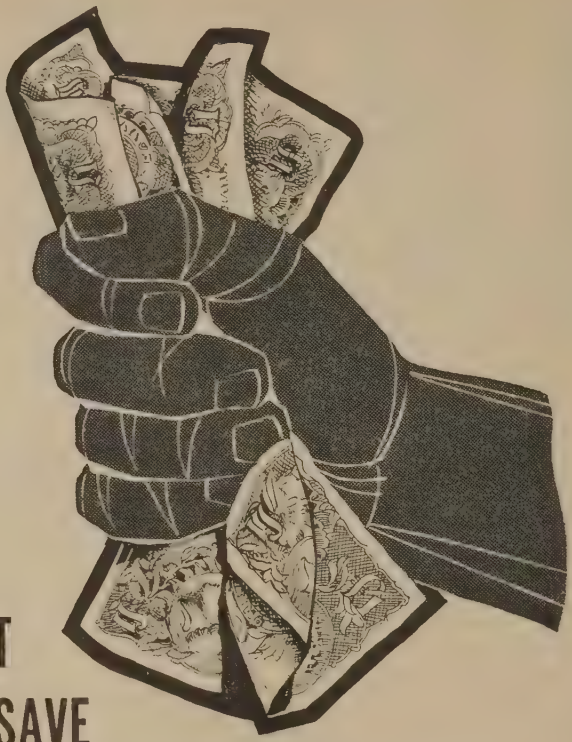
Honey Flora Calendar for August

COMPILED BY R. S. COLEMAN, APICULTURAL SECTION, WITH ASSISTANCE FROM THE BOTANICAL BRANCH

Common Name	Botanical Name	Where Found	Honey		Quality of Pollen	Remarks
			Quality	Quantity		
Bull Oak	*Casuarina Fraseriana* Miq.	Grows with jarrah and marri in Coastal Plain	None	None	Excellent	Bees work this tree for pollen, carrying in the whole anther and emptying the pollen sacks and then dropping them in front of the hive where they look like saw-dust.
	Casuarina Heugeliana Miq.	Grows throughout the Great Southern	None	None	Excellent	A very good pollen plant.
	Casuarina humilis Otto et Dietr.	A shrub growing in many places in the South-West Division	None	None	Excellent	A very good pollen plant.
Cape Weed	*Arctotheca calendula* (Linn.) Leugus	Weed	Poor-Good	Poor	Excellent	One of the best plants for pollen.
Wild Radish	*Raphanus raphanistrum* Linn.	A weed of wheat and other cereal crops	Good	Good	Good	Where the weather is suitable is very valuable in maintaining the strength of the colonies. Never enough for a real flow of nectar.
Guildford Grass	*Romulea rosea.* (Linn.) Eckl.	Weed. Widespread	Unknown	Small	Good	Builds up the bees.
Peppermint	*Agonis flexuosa* (Spreng) Schau	Coastal plain, and as an ornamental	Very poor	Good	None	Main flowering September-October.
One-sided Bottlebrush	*Calothamnus quadrifidus,* R.Br.	Widespread	Poor	Good	Excellent	Good producer, June, July, August. Good builder of strength.
Silky Blood Flower or One-sided Bottlebrush	*Calothamnus sanguineus,* Labill.	Widespread; seems to like rocky slopes either lime or ironstone	Dark, good quality	Excellent	Good	Flowers over a long period.
Geraldton Wax	*Chamaelaucium uncinatum,* Schau.	Native to coastal limestone ridges and coastal strip of Geraldton	Poor	Good	Good	Mainly an ornamental.
Poot or Red Heart or Coastal White Gum	*Eucalyptus decipiens,* Endl.	Coastal Plain, as a tree very much like the tuart and as a mallee on the Coastal Plain and in the Mallee areas	Good	Good	Good	Not a tree worked extensively by beekeepers; apparently flowers on alternate years; long-flowering August-November.
Karri (Coastal)	*Eucalyptus diversicolor,* F. Muell.	Southern Coast Denmark-Walpole, Albany	Choice	Excellent	Poor	Flowers through winter; bees store some honey, depends upon weather.
Blue Mallet	*Eucalyptus Gardneri,* Maiden	Great Southern	Excellent	Good	Excellent	Irregular flow probably due to weather; flow usually occurs at the end of its flowering period.

Lerp Mallee	*Eucalyptus incrassata*, Labill.	Widespread throughout southern areas in the mallee, wheat areas	Good	Good	Good	There is a doubt about the flowering time of this tree although it seems to flower over a long period. The main period seems to be in the winter.
Bullich	*Eucalyptus megacarpa*, F. Muell.	Associated with Coastal and Karri	Choice	Good	Good	A good build up for karri. Too scattered to be of much value.
Flooded Gum	*Eucalyptus rudis*, Endl.	Watercourses, etc. ; it is a species which is associated with water	Good	Good	Good	One of the major honey plants ; flowers alternate years. In some areas it is attacked by lerp insects that almost completely defoliate the trees. This affects flowering and the nectar flow.
Radiata Pine	*Pinus radiata*, D. Don	Plantations	None	None	It is worked by the bees and bees do well on it	Flowers August-September.
Tree Lucerne	*Cytisus prolifer*, Linn.	Cultivated plant	Good	Good	Excellent	An excellent builder of strength in the hives ; very seldom enought plants to get any honey in the hives.
Sweat or Honey Bush	*Adenanthos cuneata*, Labill	Southern sand plain	Unknown	Good	Good	Very few beekeepers operate in the area where this plant grows, and this could be one of those plants that could be a major honey plant of the future.
Holly-leaf Banksia ...	*Banksia ilicifolia*, R.Br.	Low areas but not swamp in Coastal Plain	Unknown .. .	Uncertain	Good	Long-flowering.
Menzies Banksia, Red or Firewood Banksia	*Bansia Menziesii*, R.Br.	Coastal sandplain	Good	Poor-Good	Unknown	Grows in association with other plants, keep " brood raising " going.
Pindi or Pingli Bush	*Dryandra carduacea*, Lindl.	Widespread, tends to cover a solid area and likes good clay-gravel soils	Good-poor ...	Very good . .	Very good	One of the best of the minor honey plants.
Parrot Bush	*Dryandra floribunda*, R.Br.	Widespread, on gravelly soils and limestone hills	Good	Excellent .	Very good	One of the major honey plants from results on the Coastal Plain, it seems to require heavy early winter rains to produce well, and only those plants on limestone seem to produce. This may be due to the fact that the limestone hills are along the coast and are therefore warmer in the spring.
Spider Net Grevillea	*Grevillea Thelmanniana* Hueg.	Coastal Plain	Not known	Is a good nectar producer	....	Not much known about this plant except that it is a good producer of nectar and the bees work it vigorously.
Honey Bush	*Hakea Lissocarpha*, R.Br.	Widespread	Poor	Useful	Unknown	A showy bush as obvious from its common name but in practice not very interesting to bees.
	H. scoparia, Meissn. ..	Midlands Coorow-Moora .	Good	Good	Good	Good flow ; sensitive to frosts, then nectar worked when nectar is thick.
Reminder Bush	*H. recurra*, Meissn.	Widespread	....	Worked by bees	Apparently good ..	Not enough known about this plant.
White-Bush or Kangaroo Bush	*H. trifurcata* (Sm.) R.Br.	Widespread	Good	Good	Good	A most valuable plant, both in its timing and value in building up the bees.
White Clematis . .	*Clematis pubescens*, Hueg.	A creeper widespread through the South-West Division	Unknown ...	Little	Excellent	Reported frequently as an excellent pollen plant.
	Phebalium microphyllum, Turcz.	Widespread in marginal and pastoral areas	Good	Good ..	Good	Very little known, but reported to be worth watching.

It will be seen from this list that information concerning many nectar-bearing plants is far from adequate. We would appreciate further information from beekeepers.



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WEED CONTROL IN CEREALS

By G. R. W. MEADLY, Officer-in-Charge, Weeds and Seeds Branch

WITH seeding almost completed, it is appropriate to review our knowledge of weed control methods in order to undertake any necessary planning. Although cultural operations provide the first line of attack in the control of weeds in cereals, chemicals are playing a very important and increasing part. The principles underlying cultural methods, including prevention from seeding and exhausting dormant seed reserves in the soil, are well known and it is intended to devote this article largely to the use of chemicals as herbicides, along with the various implications.

The first experimental work with hormone-like chemicals was carried out in Western Australia ten years ago, when, at Wongan Hills the yield of a wheat crop on light land was increased from 8.5 to 13.2 bushels per acre by controlling a heavy infestation of wild turnip with 4 oz. acid equivalent of 2,4-D per acre. During the intervening ten years there has been rapid development in this field and in 1959 approaching one half million acres of cereals were sprayed with 2,4-D and MCPA. Aircraft were employed for the treatment of about three quarters of this area.

The first equipment used was a boom fitted with low-volume nozzles spaced at about 15 in. centres. Apart from some nozzle refinements and improvements in the boom supports there has been little change in this type of equipment in recent years. The boom length most frequently used is 30 ft.

With a view to reducing cost of construction and also to overcome the cumbersome nature of a lengthy boom, various types of single and multiple nozzle jets have been designed. Several of these have been subjected to comparative tests for the control of wild radish in cereals. Providing wind conditions are favourable for spraying and close attention is given to pressure and prevention of blocking of the nozzle aperture, most of these units have given satisfactory results. It is understandable that they are not as precise as a boom, however, and can quite easily give strip effects if these details are neglected.

Aerial application has the advantage of speed, the capacity to handle boggy situations, and freedom from the risk of mechanical damage to the crop. The reaction of farmers to this method is shown by the fact that more than 300,000 acres of cereals were sprayed from the air for weed control during 1959. When this method was first used in Western Australia some 1½ to 2 gallons of solution was applied per acre. With a view to reducing cost of application this volume has been reduced steadily until now most of the spraying is done with one half-gallon of solution per acre. Trials undertaken and

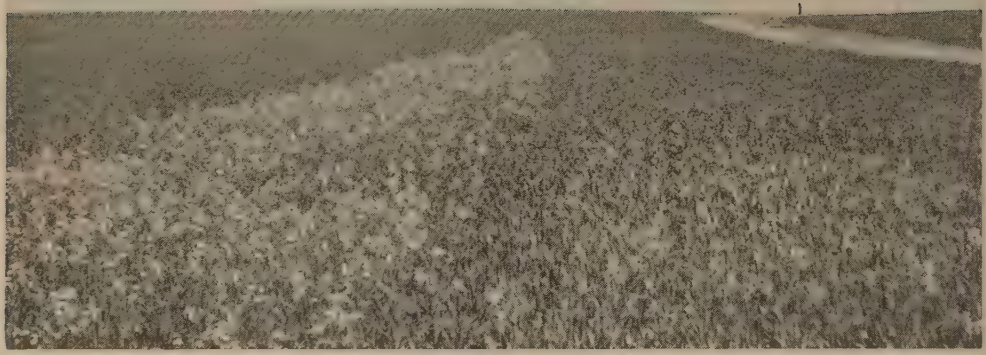

Fig. 1—The effectiveness of spray control of wild radish is illustrated by this photograph. Note the dense growth of wild radish on an unsprayed strip in a crop near Northam

field observations made by the Department have shown that, providing the boom is properly designed, and consideration is given to conditions at the time of application, there is no greater risk of having unsatisfactory results with one half-gallon than with 1½ to 2 gallons per acre.

Wild turnip is the most susceptible of our crop weeds. Four ounces acid equivallent of any formulation per acre is usually adequate.

Wild radish and wild mustard are somewhat more resistant than wild turnip. Under favourable conditions, good practical control has been obtained with 4 oz. acid equivalent 2,4-D ester or 6 oz. 2,4-D amine or MCPA per acre. When complete control is the objective, 6 oz. 2,4-D ester is recommended which could reasonably be increased to 8 oz. if conditions are likely to affect the reaction of the weed, particularly if application is being made by aircraft.

Despite the testing of a wide range of new herbicides no positive method for the control of doublegee can yet be advanced. On occasions, particularly in the Northern wheatbelt, 6 oz. acid equivalent of 2,4-D ester per acre has severely checked the weed when growing in a crop, but varying degrees of seed setting have followed.

Saffron thistle growing in a cereal crop can be controlled satisfactorily with 8 oz. acid equivalent per acre of 2,4-D ester or 12 oz. of amine. Under pasture conditions higher rates are usually necessary.

Last season, many inquiries were received concerning crops heavily infested with capeweed. This plant is fairly resistant to the hormone-like herbicides, but if farmers considered spraying was essential, rates suggested were 12 oz. 2,4-D amine per acre for oats, and 12 oz. of 2,4-D ester for wheat. These treatments killed many of the smaller plants and checked the growth of the remainder.

Many farmers have the misconception that weeds should not be sprayed until they have commenced flowering. This is certainly not the case and the earlier they are treated, bearing in mind the "safe stage" of the crop, the more advantageous the operations are likely to be. They are usually more susceptible when small and are also given less time to compete with the crop.

Plants are more readily killed when making active growth and some poor results have been traced to spraying being carried out when the weeds have been checked by dry or even water-logged conditions. Extended periods of low temperatures have also influenced results.

CROP TOLERANCE

Although there is a relatively high degree of selectivity in the case of hormone-like herbicides applied to weeds in cereals, the crop, by no means, has

absolute resistance and the risk is far greater with legumes including clovers, medics and lupins.

Research has been undertaken in this State, firstly to ascertain the stage at which the crop is least likely to be affected by the chemical and secondly the maximum dosage tolerated by the different cereals.

It is generally accepted that the "safe period" for spraying cereals with hormone-like herbicides is after the plants are stooling freely (usually 6 to 8 in. high) and before the "boot" stage when the head first becomes apparent as a swelling at the base of the leaf sheath.

With controlled experiments, no significant reduction in yield has resulted from spraying at this stage even with rates considerably higher than those normally used. There is some variation in the tolerance of wheat varieties and wheat is generally more resistant than oats with barley intermediate. During the past season in particular however, malformed heads appeared in many crops sprayed with 2,4-D. The following comments are based on the examination of a number of affected areas and also specimens received.

It would appear that a greater number of crops were affected in 1959 than in previous seasons.

Malformation.

The presence of a high proportion of malformed heads was usually associated with early spraying before stooling had progressed to any extent.

Abnormalities followed applications with both ground equipment and aircraft. One half-gallon of solution per acre did not appear to be more critical than one gallon when applied from the air.

Symptoms of frost damage are very similar to some manifestations of 2,4-D effect and this has caused some confusion. It is known that reaction to 2,4-D is influenced by various factors including soil moisture, temperature, fertilisers and soil type and it is quite possible that frosts, besides causing direct injury, have, at times, accentuated the effects of 2,4-D.

The most frequent symptom has been an irregular disposition of the spikelets as opposed to the normal series of rows. Many of the spikelets are obtusely angled from the rhachis causing "scatter heads." At times there are gaps in the spikelets resulting in interrupted heads and various forms of curvature occur in the stems, leaves and heads.

Where spikelets are missing, obviously the yield is affected but in the case of "scatter heads" a high proportion of grain is formed and satisfactory yields could be expected.

Trials with 2,4-D and related herbicides at Wongan Hills Research Station showed varying degrees of malformation depending on the formulation and rate of application. Abnormalities were not apparent on control plots and presumably frost was

Fig. 2—A wheat crop containing wild radish at the growth stage suitable for spraying

Fig. 3—A normal doublegee plant on the right, compared with a plant affected by 2,4-D. Although the sprayed plant has received a check in growth, and the characteristic swelling is present, it has not been killed

not a factor. Yields from these plots are being compared.

Farmers are generally agreed that any reduction in yield would be less than that caused by competition from weeds if spraying had not taken place.

Dark Colouring.

Reports have been received of dark strips becoming apparent in wheat crops nearing maturity. Some farmers have associated this condition with the aerial application of herbicides and, in particular, very low volumes (one quart per acre) or the use of oil as a carrier for the 2,4-D.

The dark colour is manifest in both the straw and the heads but does not appear to be linked with growth abnormalities. We have not been able to draw any conclusions from the few cases examined and would like to hear from farmers concerning any experiences of this nature.

Clover and Medics.

Some detailed work has been done on the tolerence of Dwalganup subterranean clover to hormone-like herbicides. The lethal dose for this plant is relatively high, but small amounts, particularly of 2,4-D ester will delay flowering to the extent of being critical in the season of sowing. Recommendations for crops undersown with clovers may be summarised as follows:—

Wild turnip is controlled by 4 oz. acid equivalent per acre of MCPA and 2,4-D amine. When this is the only weed concerned one of these formulations should be used.

Although the most effective chemical for the control of wild radish and mustard, under normal circumstances, 2,4-D ester is not recommended for spraying these weeds in a crop undersown with subter-

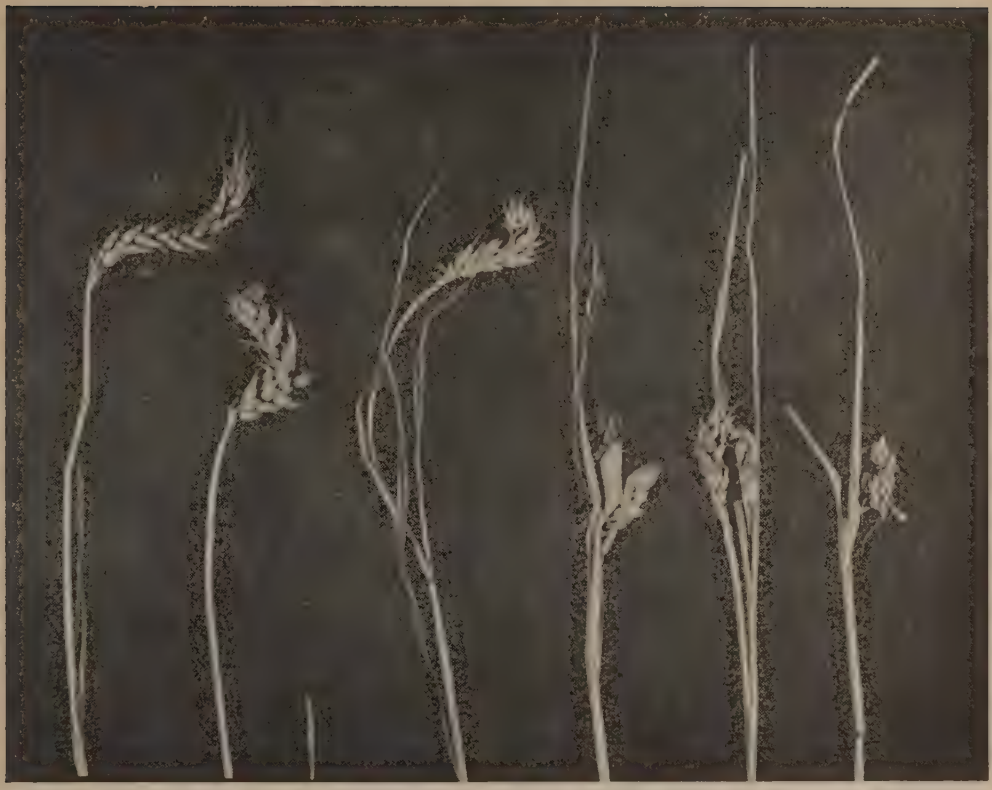

Fig. 4--Malformed heads of wheat resulting from crop spraying with 2,4-D. The generally-accepted "safe period" for spraying cereals is after the plants are stooling freely but before the "boot" stage

Fig. 5—Aerial spraying for weed control

ranean clover. Six to eight ounces acid equivalent per acre of 2,4-D amine or MCPA should be used, the MCPA being preferable if the clover plants are unthrifty.

This recommendation would also generally apply in the case of a crop sown on old clover land. When a substantial regeneration from dormant seeds can be expected, however, the stand is unlikely to be affected appreciably by four or even six ounces acid equivalent of ester per acre, which could well be used if a crop is badly infested or conditions are not favourable for weed control with growth regulators.

These recommendations apply when spraying is undertaken at the growth stage of minimum risk to the cereal. The clover plants are then usually about four inches across and have passed the very sensitive seedling stage.

Similar work has not been undertakin with barrel medic and lupins but the medics are known to be even more susceptible than the true clovers and lupins also have little tolerance.

Besides the possibility of affecting plants growing in association with the crop being sprayed there is always the risk of causing damage to susceptible species in the vicinity of operations. In most cases where damage has occurred, spray drift rather than volatility has been responsible. Ground spraying carried out when an appreciable wind is blowing in the direction of the sensitive plants can cause trouble but most instances of damage have been related to aerial application.

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TREES of Western Australia

By C. A. GARDNER, Government Botanist

No. 71—COARSE-LEAVED MALLEE

(*Eucalyptus grossa* F. Muell. ex Benth.)

THIS mallee is unmistakable by reason of its peculiar habit and thick rough-barked stem and branches, both of which have longitudinally-fissured persistent bark right up to the distinctly reddish branchlets. The leaves are broad and thick, a bright shining green in colour, with the mid-ribs usually a purplish-red. The heads of flowers are on thick red round-in-section foot-stalks which hang almost vertically, and the reddish bud-cap conceals the ultimately free, bright yellow filaments. The widely-spreading thick branches, and in general the rough stout appearance of the shrub inspired the name "grossa" from the Latin *grossus* meaning thick.

Originally described from specimens collected by Maxwell in the vicinity of the Phillips River, the main centre of distribution lies to the east, along the upper reaches of the Young and Lort Rivers, and northward to Salmon Gums, where it occurs sporadically in thickets of tea-tree on yellow clay or loamy soils. The plant seldom exceeds six or eight feet in height. It is not infrequently associated with such soils in proximity to granite rocks.

This remarkable species has no close relationship with other species of *Eucalyptus,* nor has the plant any known economic value, apart from the part it could play in horticulture. Being hardy, it would thrive in most localities in the South-West, and could be a distinct ornament in any garden or shubbery. It would however require space for its ultimate development, since although not of any appreciable stature, it can occupy a lateral diameter of up to ten feet.

No. 72—DESMOND MALLEE

(*Eucalyptus desmondensis* Maiden & Blakely).

THE Desmond mallee has a somewhat restricted range in the Ravensthorpe district, but is by no means confined to Mount Desmond, where the writer collected the first specimens in May, 1924. Rather is it distributed over a fairly large area of the Ravensthorpe Range, and some distance to the east of this. It is one of our more attractive mallees, a shrub up to 10 or 15 ft. in height, with slender stems up to four inches in diameter, the bark rough and flaky at the base, but the stems soon smooth and almost white with a powdery bark.

The branches are flexuose and often drooping, giving the plant almost the general appearance of *Eucalyptus sepulcralis.* The leaves are comparatively broad, blue-grey in colour and rather thick without any evident veins, but these can be seen under a lens. The flowers are individually almost without stalks, and borne on broad stalks under the umbel, and the buds are a chestnut-brown in colour. The operculum is somewhat variable in shape, varying from narrow and acute to somewhat broad and almost blunt. Both forms are depicted on the accompanying plate. The fruits are on very short stalks, and somewhat bell-shaped; the valves never projecting beyond the rim of the fruit. The filaments are pale yellow when fresh, but dry to a yellowish-brown colour.

On Mount Desmond the shrub grows in stony soil on the lower slopes of the hill, but in some places it may be found in clay. It flowers in the winter and spring, from May to November.

THE DESMOND MALLEE

(*Eucalyptus desmondensis* Maiden & Blakely)

A—Branchlet with buds and flowers; B—Flower-buds; C—Anthers; D—Fruits; E—Single fruit (enlarged); F—Section of same, Mount Desmond, Gardner May 1924 (Type); G—Flower-buds; H—The same enlarged, Ravensthorpe district (Gardner 2935, November 1931)

Eucalyptus falcata Turcz.

A—Fruits; B—Flower buds, Mundaring catchment area, D. H. Perry (this is the typical form); C—Flower-buds; D—Fruits; E—Section of flower-bud; F—Section of fruit; I—Anther, Hatter's Hill, Gardner; G—Flower-buds; H—Flowers, 35 miles westwards from Esperance, G. H. Burvill.

This species is singularly attractive, and could be trained to grow for street-planting purposes.

No. 73—*Eucalyptus falcata* Turcz

THIS species occurs as a mallee, or as a tree: when the latter it has a smooth pale bark, and is known as "White Mallet" in the Narrogin and Wagin districts; as a mallee it has an extensive area of distribution, extending from the Helena River in the Mundaring Catchment Area, southward to the south coast between the Stirling Range and Esperance. In both tree and mallee forms we find a smooth or longitudinally-furrowed fruit, but this character is unimportant, since considerable variation occurs between the two.

The first specimens were collected by Drummond, probably in the districts to the east of the middle parts of the Great Southern district. In this area the species maintains a distinctive form, with slender stalks, long and acutely-pointed buds, a usually faintly ribbed fruit, and green, shining, narrow leaves. In the south—especially in the regions of the south coast eastward from the Pallinup River—it undergoes some changes, the buds and fruits being entirely smooth in some cases, and the bud-cap sometimes short and broad. These latter forms are sometimes easily mistaken for "Redheart" *q.v.*, but always there is a definite stalk to the buds and fruits. It is not until we reach the longitude of the Phillips and Jerdacattup Rivers that we find much alteration to these organs, but at Hatter's Hill a robust form is found, which is shown in Figs. C, D, E and F. This form shows a tendency towards *Eucalyptus goniantha,* but always there is a more or less slender stalk to the buds and fruits, sometimes thickened upwards. Farther east, in the sand near the coast, the buds become smaller on shorter, thicker stalks, and it is here that the species most closely approaches *Eucalyptus decipiens.*

The bark of the tree form is not high in tannin, and is sometimes added to brown mallet bark as an adulterant.

No. 74—JERDACATTUP MALLEE

(*Eucalyptus goniantha* Turcz.)

THIS species of Eucalyptus appears to have been much neglected, and remains imperfectly known. It was, unfortunately, described without fruits, but we possess fragments of the leaves and flower buds of the original specimens collected by Drummond in his Third Collection (No. 71). This mallee, or something very closely resembling it, was collected by Maxwell from the Franklin River in fruit only. It was also collected by Collie and Baxter from the east of King George's Sound.

It is unfortunate that material from so many sources, all of it incomplete, became described under the one name, but I believe that even so, all of the earlier collections, or at least those of Drummond and Maxwell, and one other, are referable to the one species.

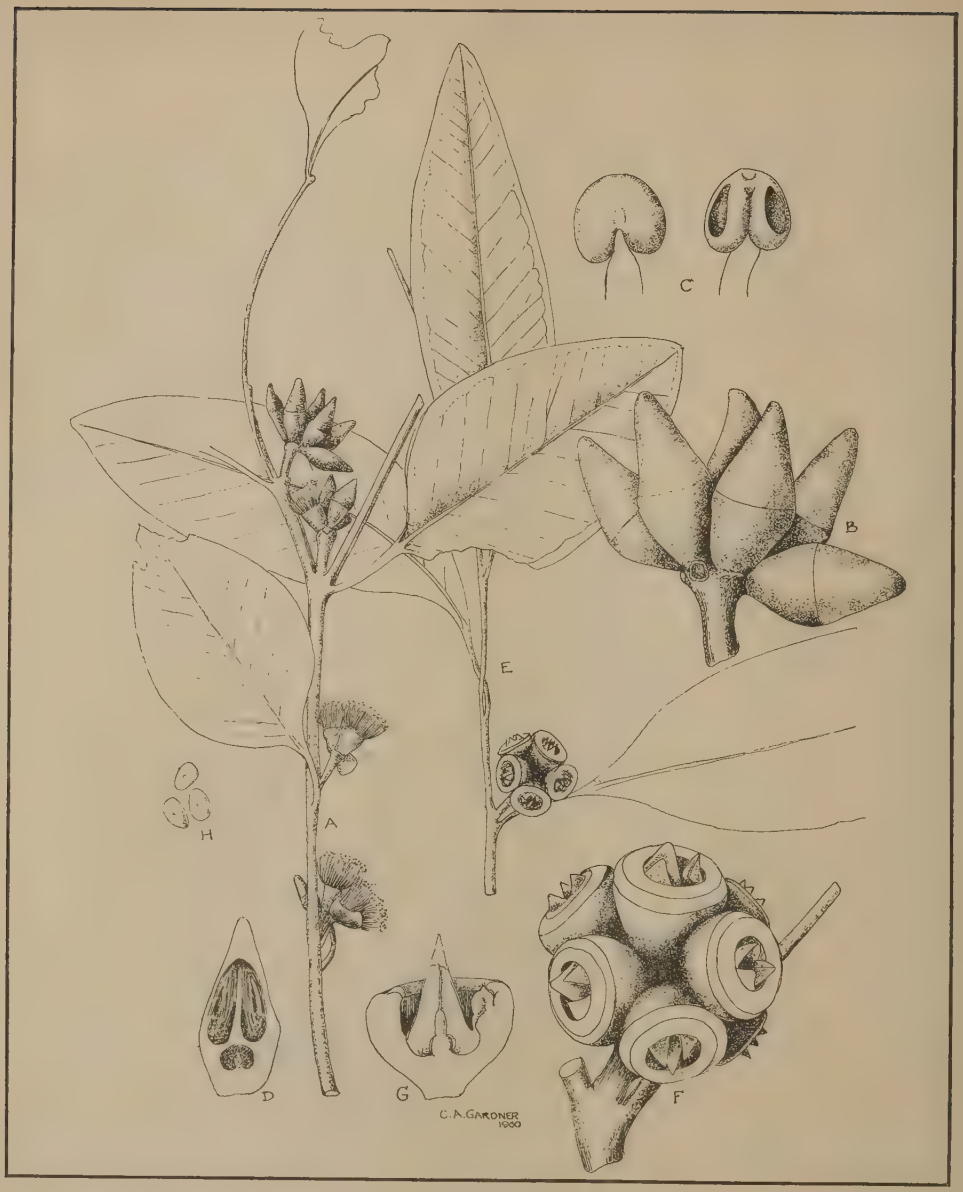
We do not know where the Franklin River is, but it seems certain that it was somewhere between the Pallinup River and Cape Arid, and it is between the Jerdacattup River and the Dalyup River that we find a robust mallee with rather thick, dark green, rather finely-veined leaves, somewhat massive buds with pale-coloured almost conical streaked or ribbed caps, and a deeply ribbed fruit.

It occurs on stony clay soil, often on the sides of hills and on breakways. The original specimens of Drummond's which I have seen are more longitudinally-wrinkled in the bud than those which have been subsequently collected, but this may be the result of immaturity, as can be demonstrated in other species. The bud-cap varies from smooth to longitudinally-ribbed. Along the south coastal areas the species is a thick-leaved mallee and the buds are in clusters of four to eight, with the fruits more or less pear-shaped.

To the north of Esperance we find a mallee of more spreading habit rarely exceeding four to five feet in height, in which the flowers appear to be constantly in groups of three, and the fruit is more coarsely ribbed. Still farther north—in heavier soil—it becomes larger, and near Circle Valley a tree form occurs up to 45 ft. in height with a rough persistent bark. Farther north, in clay soil we find it as

THE JERDACATTUP MALLEE
(*Eucalyptus geniantha* Turcz.)

A—Flowers and buds; B—Anthers, Drummond (type collection); C—Buds and fruits; D—Anthers; E—Section of fruit, Jerdacattup River (Gardner December 1940)



"REDHEART"

(*Eucalyptus decipiens* Endl.)

A—Branchlet with flowers and buds; B—Flower buds enlarged); C—Anthers; D—Flower bud in section; E—Branchlet with fruits; F—Cluster of fruits (enlarged); G—Fruit in section; H—Seeds

(Toll's Pass, Stirling Range, Gardner 1931)

far as Salmon Gums as a rather tall mallee in yellow, loamy stony soil. This has been described as *Eucalyptus Kessellii*, but from an examination of the whole range of forms it must be regarded as merely a form of *Eucalyptus goniantha*. We have here an excellent example of variation according to soil and climatic conditions.

No. 75—"REDHEART"

(*Eucalyptus decipiens* Endl.)

THIS tree attains a height of about 45 ft. in limestone soils, but in sandy depressions it is a much smaller tree, and sometimes has a mallee form. The better specimens are found in the limestone tract which extends from near the coast at the Moore River southward to the vicinity of Rockingham, where it is a tree with a rough light grey bark which could easily be mistaken for a tuart tree, but it is of more spreading habit and somewhat untidy. Unlike tuart the timber is red, and the trunk attains a diameter of over two feet in well grown specimens.

The other area of distribution is found under totally different conditions in the south, where from Katanning to Denmark, and again towards the Stirling Range, the tree is found growing in poor sand subject to very wet conditions in winter. These trees rarely exceed 20 or 25 ft. in height, and have usually gnarled or twisted trunks and widely-spreading, untidy branches. It is not a handsome tree. The bark too is darker in the trees from the limestone farther north, but the timber is of the same deep red colour. It is, in this latter habitat, a tree of the sandy depressions. The mallee forms are found around the Stirling Range and the low-level plains to the east. This mallee form is at times difficult to distinguish from *Eucalyptus falcata*, but always the buds and fruits are to all purposes stalkless, whereas those of *Eucalyptus falcata* are distinctly stalked.

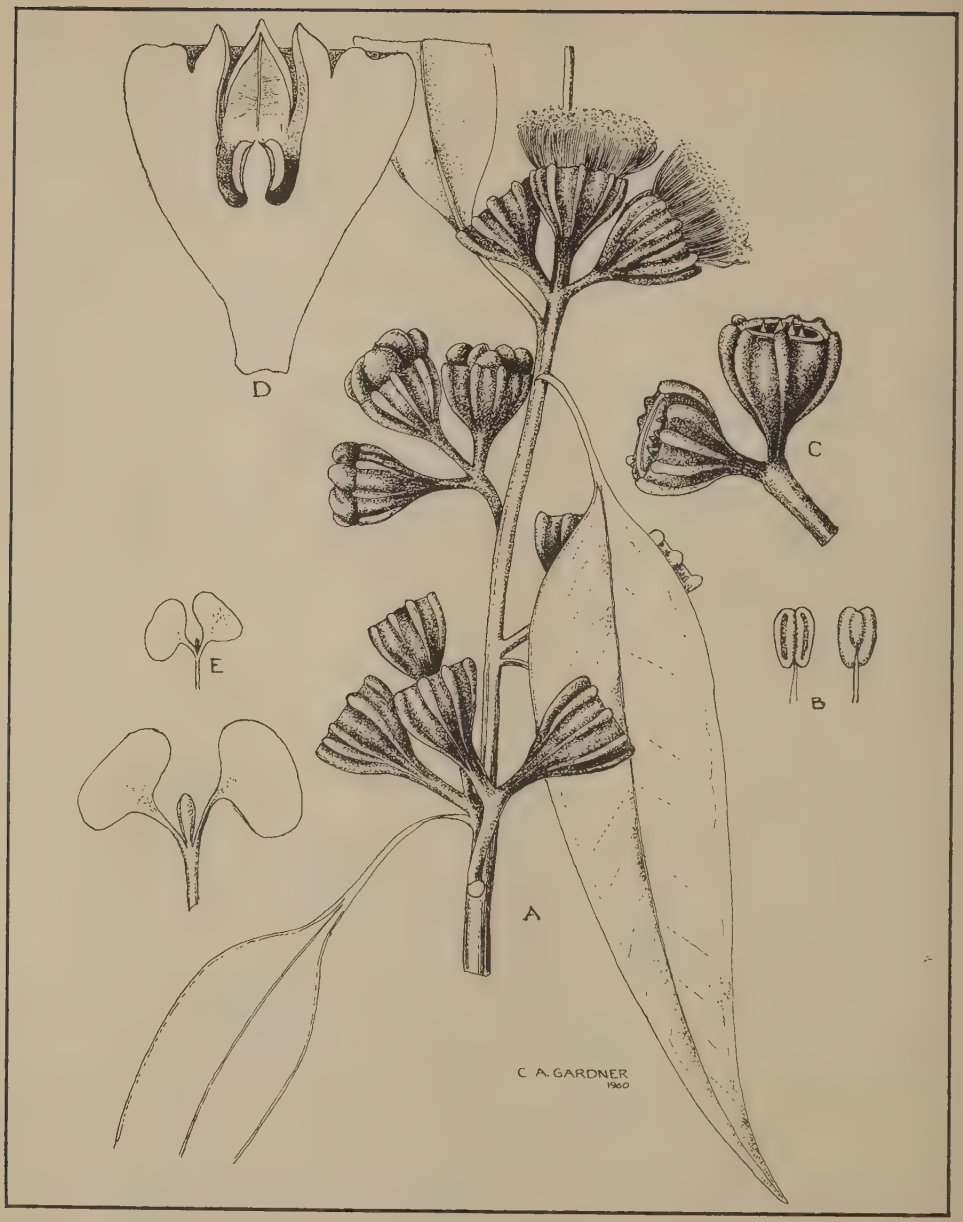
The anthers of *Eucalyptus decipiens* exhibit some diversity in size and form. They have been described as opening in pores, and this is sometimes true of the immature anthers, but in the fully mature state they are found to open in parallel slits as illustrated in the accompanying plate. Considerable importance has been given to the shape of anthers and their dehiscence (i.e., their method of opening), but detailed examination has shown that too much reliance cannot be placed on this character: for example, when the plate of *Eucalyptus sepulcralis* was prepared, at least four anthers had to be examined before one was found in which the slits were joined at the apex, and similarly in *Eucalyptus desmondensis* we found a similar state of affairs. The anthers of *Eucalyptus decipiens* are not unlike those of a number of tropical species which have been described as opening in pores, but the important thing is that the filament is attached above the base of the anther, whereas those Western Australian species which have anthers opening in what might be called small pores, open nearly at the top, and the filament broadens at the apex into the anther.

No. 76—*Eucalyptus corrugata* Luehmann

THIS species varies from a fairly large mallee to a tree of about 35 or 40 ft. in height, with either a quite smooth bark the outer layers of which shed in long plate-like pieces, or the lower part of the trunk is covered with these persistent outer layers of bark which give it a rough dark "blackbutt" appearance.

The bark, although appearing smooth, is slightly rough to the touch. It is a yellowish-brown in colour when the outer bark has newly shed, but later becomes a creamy white. The timber is a pale brown and hard, and straight-grained, and the leaves are a bright shining green. The flowers are borne in umbels of from three to seven on short pedicels; the common stalk or peduncle of the umbel is about half an inch long. The buds and fruits are prominently ribbed, and the bud-cap or operculum is normally broad and blunt, being almost hemispherical, and is even more prominently ribbed than the calyx.

Eucalyptus corrugata grows on stony soil, usually on rising ground, and its range



Eucalyptus corrugata Luehmann.

A—Branchlet with buds, flowers and fruits; B—Anthers; C—Fruits; D—Section of fruit; E—Cotyledons (Westonia, Gardner 1095)

GOLDFIELDS BLACKBUTT
(*Eucalyptus Le Souefii* Maiden)

A—Branchlet with buds; B—Anther; C—Branchlet with leaf and fruits; D—Fruits; E—Fruit in section; F—Cotyledons
(Higginsville, Gardner 9535)

extends from Westonia to near Coolgardie and some distance southward. The typical form has the obtuse, almost hemispherical, prominently ribbed or almost winged bud-cap, and the leaves are a shining green. It is never a large tree. Specimens from Goddard's Creek near Zanthus show all of the characteristics of this species except that the bud-cap is beaked, and this latter character is usually reserved for *Eucalyptus Le Souefii*, the common blackbutt of the Eastern Goldfields.

No. 77—GOLDFIELDS BLACKBUTT

(*Eucalyptus Le Souefii* Maiden).

THIS tree, common in the Kalgoorlie-Norseman district, is found mainly on the alluvial flats, and attains a height of 45 ft. when well grown. The bark is flaky and persistent in the lower part of the trunk, from one or two to six or eight feet above the ground level. Above this it is smooth and light silvery-brown in colour.

The branchlets are reddish and the leaves a dull greyish-green in the common form, although forms with shining leaves have been observed. The dull, narrow leaves, the more pointed bud-caps, and usually the more pronounced blackbutt at the base of the trunk are the principal features which separate this tree from *Eucalyptus corrugata*, but none of these characters is constant.

Specimens from Goddard's Creek near Zanthus, have all of the characteristics of of *E. corrugata*, but the buds have the beaked bud-cap which is a characteristic of *E. Le Souefii*. Still another form from the Norseman district has lustrous leaves and remarkably long, pointed bud-caps. Perhaps all three should be grouped as a single species.

The range of the typical form of *Eucalyptus Le Souefii* extends from Kalgoorlie to Norseman, and westward to Coolgardie. As previously stated, it grows on low-lying flats and shows a certain tolerance to salt.

No. 78—STRICKLAND'S GUM, OR GOLDFIELDS YELLOW-FLOWERED GUM

(*Eucalyptus Stricklandii* Maiden).

FEW trees are more attractive than this species of Eucalyptus which grows on the stony hills between Coolgardie and Norseman, and eastward to the Fraser Range. Its heavy pale green foliage, attractive cinnamon-coloured bark above the rough black base, and its masses of large lemon-yellow flowers make it an outstanding tree. Although its natural habitat is confined to stony, usually schistose hills in the Eastern Goldfields, it is equally at home in the poor white sand of the coastal regions, or in the sandy or clay soils of the wheat districts.

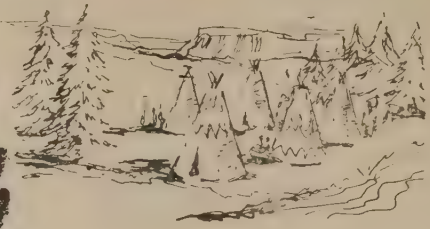
Its specific name commemorates a former Governor of Western Australia, Sir Gerald, later Lord, Strickland, who was subsequently Governor of New South Wales, and of Malta.

The tree is not a tall species. Rarely does one see it more than 20 or 25 ft. tall, but it has a short massive trunk up to two or three feet in diameter, and widely-spreading branches. The bark of the trunk, or at least the lower part of the trunk, is covered with a persistent, dark grey or almost black curly-flaky bark which terminates abruptly and is succeeded by a smooth reddish-grey or cinnamon-coloured bark. The ultimate branches and branchlets and the flower-buds are covered with a white powder. The whole tree, in fact has a singularly lucid appearance. It flowers in late November and December.

The accompanying plate illustrates this species, which is quite distinctive, with no close relationships within the genus except *Eucalyptus Carnei* which grows in the Sandstone district. Points which should be observed in *Eucalpytus Stricklandii* are the stout, flattened, common flower-stalks, the stalkless individual flowers, the shape of the fruit and the cylindrical-ovate operculum which is yellow when the bud is ready to burst.

STRICKLAND'S GUM, OR GOLDFIELDS YELLOW-FLOWERED GUM
(*Eucalyptus Stricklandii* Maiden)

A—Branchlet with flower-buds; B—Flower-bud in section; C—Anthers; D—Branchlet with fruits; E—Section of fruit; F—Cotyledons (Widgiemooltha, Gardner 1050)



THE CALUMET

To the early American pioneers, the symbol of peace and friendship was the CALUMET—the name given by the French in Canada to the "Peace Pipe" of the American Indians. With a bowl of soft red stone and a long reed for a stem, the CALUMET is usually decorated with eagle quills or hair and is smoked on all important and ceremonial occasions. Although its special function was at the making of Treaties of Peace, the CALUMET has also been smoked between the chiefs of uniting tribes in their wars against the early white settlers. However, the offering of the CALUMET is a supreme proof of hospitality and this significant tradition is still practised today. In Australia, Elders have for over 120 years, symbolised the tradition of service to the man on the land and at all times offered specialised assistance in all matters relating to Stock, Wool, Land, Insurance, Merchandise or Travel.

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Bracken Poisoning IN CATTLE

By P. B. LEWIS, B.V.Sc., District Veterinary Officer, Manjimup

THE ingestion of bracken fern causes the death of numbers of young cattle in the South-West of Western Australia every year. Early experimental work in the United Kingdom demonstrated that bracken contained an anti-Vitamin B1 factor called thiaminase which was thought to be the cause of the poisoning, but later work indicated that a bone marrow poisoning, not yet chemically identified, was responsible.

The damage to the bone marrow tissues leads to a reduction in the number of white blood cells (necessary for protection against infection) and thrombocytes (necessary for blood clotting). At the same time there is an increase in the fragility of the capillaries or small blood-vessels.

SYMPTOMS

Dullness and lack of appetite are followed by discharges from the nose and mouth. Later there is fever with small pin-point haemorrhages under the skin. Ulceration of the bowel with sloughing of the bowel lining and internal bleeding are usually present and blood is seen in the droppings.

Post-mortem examination shows bleeding under the skin and possibly in the heart, lungs and intestines. The bowel may contain clots of blood and may show signs of gastro-enteritis with sloughing of the lining.

Death may occur from simple internal bleeding but, as will be explained later, the animal may suffer from septicaemia due to its inability to deal with secondary infections.

TREATMENT

The effect of simple bracken poisoning in cattle is very similar to that of X-radiation, and previous knowledge of this type of damage in man gave rise to some experimental work on treatment in cattle.

Evans and others carried out trials of a substance, DL-batyl alcohol which occurs naturally in very small quantities in bone marrow, spleen, liver, aorta and red blood cells. It is found also in concentrates of the liver oil of the Greenland shark.

Synthetic batyl alcohol given by slow injection into the bloodstream and supported by treatment with antibiotics and sulpha drugs, raised the recovery rate from about one in four to three in four, but the cost of the treatment (about £10 per animal) is likely to limit its use.

Another treatment consists of injections of live bone marrow cells. These act as a graft, migrating to the bone marrow where they multiply and replace the bracken-affected tissues.

HAEMORRHAGIC SEPTICAEMIA

This disease, which is also known as Pasteurellosis, is caused by Pasteurella germs which may be present in the lung tissues of normally healthy animals without causing ill-health. When an animal's resistance is lowered however, the Pasteurella organisms can multiply rapidly, resulting in fever, salivation, increased rate of breathing and pneumonia which is often fatal.

It was suggested that bracken poisoning, by causing bowel damage, could facilitate

the entry of Pasteurella organisms into the tissues. As a means of preventing the infection, calves in the Bridgetown, Manjimup and Pemberton districts were commonly given injections of killed Pasteurella vaccine.

As mentioned earlier in this article, bracken poisoning affects the bone marrow and destroys the white blood cells which protect the body by their constant battle against invading germs. It is now thought that it is the bone marrow damage, rather than the damage to the bowel lining which is responsible for the frequent association between bracken poisoning and haemorrhagic septicaemia.

Animals vaccinated with Pasteurella vaccine will usually exhibit increased resistance to Pasteurella infection, and may escape or recover from the pneumonic condition. They may succumb however, to internal haemorrhages caused by the advanced stage of bracken poisoning.

Antibiotics and sulpha drugs, which may give good results in the treatment of Pasteurellosis are ineffective in the case of simple bracken poisoning.

VACCINATION PROBLEM

For some unknown reason, a number of calves vaccinated in the Manjimup area during 1959, were seriously affected by Pasteurella vaccination. Similar trouble has been reported from overseas, prior to the West Australian experience.

Within a few minutes, or occasionally up to two hours, after vaccination with as little as 1 cc. of the vaccine, some of the animals showed considerable distress. Uneasiness, followed by slobbering, increased breathing rates, and stamping with signs of abdominal pain were the usual preliminary symptoms. Affected animals may cough up froth from the lungs and eventually go down gasping for breath and showing a blue colouration of the normally pink membranes of the mouth and tongue.

Prompt treatment by injecting 1 to 2 cc. of 1 : 1,000 Adrenaline intramuscularly is usually effective. Probably 5 cc. injected under the skin would be equally effective.

Precautions.

- The recommended dose of vaccine was formerly 5 cc. with 10 cc. given ten days later. *This has now been reduced to 1 cc. followed by 3 cc. a week later.*
- Try a test batch of say five animals, to observe the reactions, before going ahead with the vaccination of larger numbers.
- Preferably treat in small batches so that treatment with Adrenalline can be applied quickly if necessary.
- Try to vaccinate when the weather is cool. Hold the animals in a shady spot before and after vaccination.
- Do not disturb animals unnecessarily for about two hours after vaccination. During this time, a close watch may be necessary although, it is generally experienced that the more severe cases occur early, that is within about half an hour.

SUMMARY

Bracken fern poisoning is due to a toxic principle in the fern causing bone marrow damage. Treatment at the present time is uneconomical.

Mild cases of bracken poisoning are probably widespread and the use of Pasteurella vaccine helps to prevent affected animals from contracting Pasteurellosis in their weakened state.

Some animals are allergic to Pasteurella vaccination and precautions and treatment are outlined.

WEEDS of Western Australia

By **G.R.W. MEADLY** M. Sc.
Officer in Charge, Weeds and Seeds Branch

CAPE TULIP

(*Homeria Breyniana* (L.) Lewis* and *H. miniata* Sweet)

SOUTH Africa has provided us with a number of undesirable weeds including double-gee, Berkheya thistle, Guildford grass and stinking roger, but outstanding among the weed introductions from that country are two species of Homeria known as Cape Tulip. The salmon-coloured flowers and long grass-like leaves are known to farmers in many localities extending from Geraldton to Albany and as far east as Bruce Rock and Merredin. Beyond the metropolitan area the largest infestations occur in the Northam, York, Beverley and Williams districts where thousands of acres of good land are affected.

Cape Tulip provides one of the many examples of a plant cultivated for ornamental purposes soon becoming a serious weed. As early as 1859 it was included in the first catalogue of garden plants issued by the Adelaide Botanical Gardens and was probably introduced some time before that date. By 1890 both species were established as weeds in South Australia, Victoria and Western Australia and their appearance in New South Wales was not long delayed.

Although probably first introduced to this State as a garden subject it has since been distributed in several other different ways. Hay and chaff cut from infested paddocks have been responsible in many cases and Cape Tulip occurs on a number of old camp sites where horses were fed. Stock and farm machinery have played their part along with subterranean clover burr and ungraded lines of clover seed. The weed has been distributed with gravel used for ballast, also with packing material and in balled fruit trees. It favours moist situations and has been spread along gullies by running water.

DESCRIPTION

The vernacular name is derived from the country of origin, South Africa, where species of *Homeria* are referred to as "tulps." *H. Breyniana* is known as One-leafed and *H. miniata* as Two-leaved Cape Tulip.

Homeria Breyniana has a single, ribbed, grass-like leaf 12 inches or more long arising from a corm (the so called bulb) which is surrounded by brown fibrous material. The stem is shorter than the leaf and produces a few flowers which are, at first, enveloped by green spathes. Each flower has six segments which are usually predominantly pink with a green or yellow base, but are sometimes entirely yellow. The flowers often exceed an inch in diameter. The narrow cylindrical seed vessel opens at the top to liberate numerous brown seeds.

Homeria miniata has two, or sometimes more, grass-like leaves and in consequence is often referred to as Two-leaved Cape Tulip. These arise from a corm around which are formed numerous cormils (small "bulbs") the whole being surrounded by

* *Homeria Breyniana* (L) Lewis was formerly known as *Homeria collina* Vent.

A to I—ONE-LEAFED CAPE TULIP (*Homeria Breyniana* (L.) Lewis); A and B—Habit; C and D—Corms (D in section showing development of lateral corm); E—Flower; F—Flower in lateral view; G—Ovary, stamens and styles; H—Fruit (capsule); I—Seeds (much enlarged).
K to L—TWO-LEAVED CAPE TULIP (*Homeria miniata* Sweet); K—Habit; L—Cormils
Metropolitan District. Icon. origin.
(Drawing by the Government Botanist, Mr. C. A. Gardner. From the series "Poison Plants of Western Australia.")

Fig. 1.—Two-leaved Cape Tulip from Cuballing, August 30. Cormils have developed freely on the untreated plants on the left, while the plant on the right sprayed with 2, 4-D ester on July 13 is unthrifty, has no cormils and has the characteristic swelling immediately above the corm

dark fibrous material. The flowering stem gives rise to a number of flowers which emerge from green spathes. Each flower has six segments, pink in colour with the exception of the yellow base which is often blotched with green. The diameter of the flower seldom exceeds one inch. During the later stages of growth, groups of cormils are formed in the angles formed by the leaves and the stem. Although *H. miniata* flowers freely, no plants bearing seed have been noted in this State.

SIGNIFICANCE

Where the growth of Cape Tulip is dense, especially in parts of the Avon Valley, desirable plants are largely crowded out and in many cases the carrying capacity has been reduced by at least 50 per cent. Besides being a weed of major importance it is also a poisonous plant which has caused toxic effects even when dry.

South African natives have been poisoned by eating the corms of Cape Tulip and there are many references to losses of animals. Deaths are reported most frequently among cattle, although horses and sheep are also affected, and there is no reason to believe that pigs are immune. There is evidence to show that the poison occurs in all parts of the plants irrespective of whether fresh or dry, and an alkaloid, homeridine, has been isolated.

Animals accustomed to grazing in areas where Cape Tulip is prevalent are seldom affected, probably because they avoid eating the plant. Even under these circumstances, however, deaths occur from time to time. The most serious mortalities have been experienced among stock brought from a district free of Cape Tulip to one where the weed is present in quantity. On a number of occasions deaths have occurred in a few hours.

Further details concerning toxic properties and symptoms can be obtained from an article by C. A. Gardner and H. W. Bennetts—"Poison Plants of Western Australia—The Cape Tulip" in the November-December, 1952, issue of this journal.

Both species are declared primary noxious weeds for the entire State.

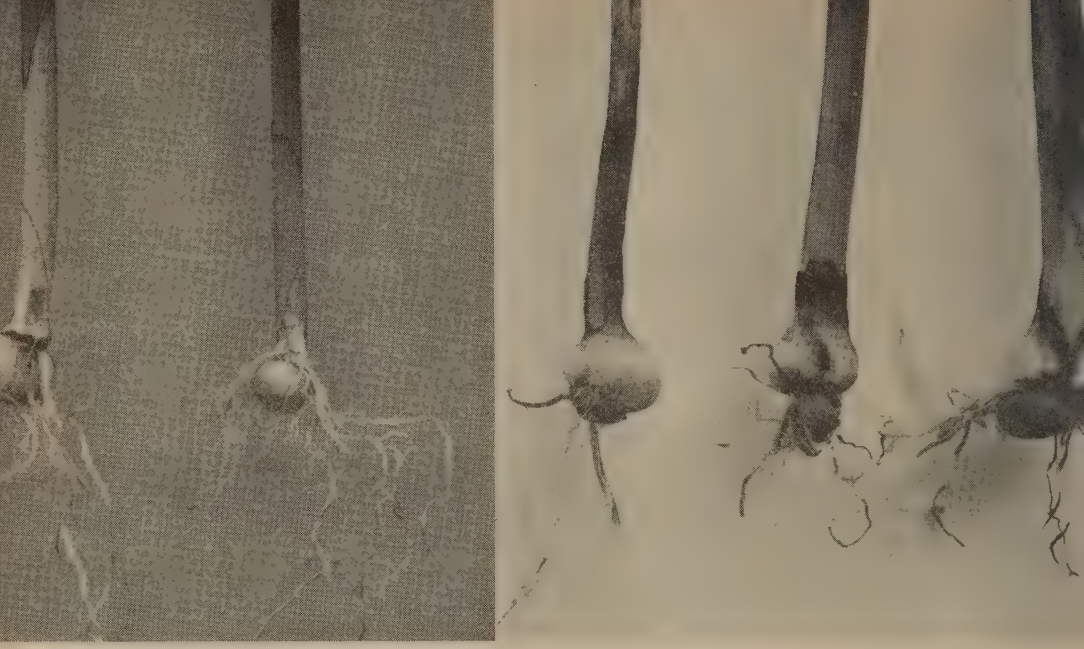


Fig. 2.—One-leafed Cape Tulip showing stages of corm development. On June 26 the old (lower) corms of the two plants on the left had commenced to shrivel but the new corms above them were only at an early stage of formation. At this stage or a little later the weed is most vulnerable to ploughing. By August 20 the three plants on the right from York and Williams had new corms nearing maturity. At this stage ploughing is not fully effective although the plants are still susceptible to 2, 4-D

CONTROL

As already mentioned Cape Tulip was present in Western Australia before the beginning of this century and during the past 50 or 60 years has been allowed to establish itself with little opposition. We cannot hope to overcome the problem in a few years, in fact Cape Tulip along with many other weeds will always be with us but there is much we can do to reduce its impact on agricultural production.

The present policy is to concentrate on those areas which are relatively small but are acting as foci for distribution. In such cases eradication is possible. With large infestations the primary objective is to prevent further spread at the same time systematically tackling the area with a view to reducing its extent.

When considering the control of weeds, particularly perennial weeds such as Cape Tulip, it is important to take into account their life-history. This is underlined by the two closely related species of Cape Tulip. The two-leaved type, although flowering freely, does not produce mature seeds but these are replaced to a large extent by a considerable number of small cormils which form around its basal corm or bulb and also in the angle between the leaves and the flowering scape. On the other hand the one-leafed type seeds freely and also multiplies by the formation of a few corms at the base but does not produce the characteristic cormils of the other species. It is obvious that prevention of seeding alone will not eradicate Cape Tulip and attention must also be given to both the corms and cormils.

Although well adapted for propagation and not easy to control, good results have been obtained with both cultural and chemical methods.

Ploughing should be carried out with a disc or mouldboard, or a rotary hoe used when the corms are at the transition stage. This stage, which is dependent to a certain extent on the season and soil conditions, usually occurs in July. The old or lower corm has shrivelled appreciably and the new or upper corm or corms have only partially formed.

In order to be effective, ploughing must be done thoroughly to the depth of the corms. Half turning the plants will allow many of them to continue growing and a cultivation following the ploughing is often necessary.

Owing to the presence of dormant corms, complete destruction with one operation is not possible although a big reduction, at times more than 90 per cent. has been obtained in the first year. For this reason, ploughing, grubbing or chemical treatment must be continued for several years. The proportion of dormant corms can be reduced by having little dry herbage on the surface at the beginning of autumn. A fire helps in this respect.

On some land it is possible to sow an early-maturing crop following ploughing at the critical time but much Cape Tulip infested land is too boggy to plough at the time most favourable for the control of the weed. With land of this nature it is better to plough early than to wait until the soil becomes firm in the spring. A cropping and fallowing programme continued for several years has effected a big improvement on several properties in the Avon Valley. Crops should be cut for hay only if no mature seeds or stem cormils are present. At times cropping with peas fits into such a control programme, particularly in the Avon Valley.

Although cultural operations must be accepted as the first line of attack, the value of an effective chemical has always been recognised. Fence lines, rocky situations and uncleared country present difficulties for ploughing, along with boggy areas which have already been mentioned. Many chemicals have been tried over a period of years mainly with indifferent results.

Some degree of control has been obtained by the application of oils including a mixture of old sump oil with kerosene or diesolene at the rate of one gallon per 24 square yards of Cape Tulip. Results have been variable, however, and the treatment is very costly.

Some trials with 2,4-D commenced in 1950, gave encouraging results and comprehensive experiments have since been undertaken over a wide area extending from Geraldton to Cranbrook, to ascertain in particular, the most effective formulation, optimum rate of application and most satisfactory time for spraying. We have learnt much from these experiments and also the large scale operations carried out against this weed in recent years.

Fig. 3.—Two-leaved Cape Tulip showing young plants developing from cormils surrounding the corm. The photograph was taken on July 18.

The highest degree of control and most uniform results have been obtained with 2 lb. of acid equivalent of 2,4-D ester per acre of Cape Tulip. Good results have also been associated with the same rate of both the amine and sodium salt of 2,4-D. On occasions these have been just as effective as the ester, but at other times have been somewhat inferior.

Under favourable conditions, especially in the case of fairly sparse infestations, one pound of acid equivalent per acre has caused a substantial reduction. For reasons of economy this rate may be used to advantage under some circumstances where maximum reduction in the first year is not of primary importance. With spot

spraying of scattered growth the higher rate is strongly recommended.

Both high and low volume treatments have proved effective. Application can be made by means of a knapsack, a hand lead from a power unit or a low-volume boom. One hundred gallons per 48 square yards is a convenient rate when using a knapsack or a hand lead although some operators prefer considerably less, especially with a hand lead. Complete coverage, however, is important. With low volume boom units eight gallons per acre is a satisfactory rate.

several instances plants sprayed at the bud stage have been killed and the associated new corms affected.

Light rain a few hours after application is unlikely to reduce the efficiency of the treatment, but, as far as possible, spraying should be undertaken in fine weather or at least when rain is not imminent.

Some time often elapses before any effect of 2,4-D on Cape Tulip can be noticed, in fact an accurate estimation of results is not often possible before the growing period in the following season. The most obvious symptoms are a twisting of the

Fig. 4. — Two-leaved Cape Tulip at Cuballing showing the control on a 30 ft. strip sprayed at the rate of 2 lb. acid equivalent of 2, 4-D amine with a low volume boom on July 14, 1952. Photograph May 27, 1953

It is important to ensure that the quantity of chemical required per acre is contained in the volume used.

With a view to coping with boggy situations, some spraying has been undertaken with aircraft applying about two gallons of solution per acre. Some good results have been obtained but this method is not favoured if ground equipment can be used. Low flying is essential and where this has not been possible, due to trees and other obstructions, poor results have invariably followed.

The most appropriate time for application varies somewhat with the season and is not the same for the two species. With the two-leaved type, July treatments at the corm transition stage favoured for ploughing have proved satisfactory and the work can be continued into August. The optimum time for the one-leafed species is somewhat later, August being the main month, with satisfactory work also being undertaken in September. In

foliage along with a swelling of the basal portion of the plant above the corm.

With spraying, as with ploughing, the dormant corms are a problem. In many cases more than 90 per cent. control has been obtained in one season but measures must be continued for several years. The most practical programme varies with conditions and often spraying one year can be followed to advantage by ploughing and cropping in the subsequent year or the reverse order may be favoured.

There have been some instances of poor results following treatment, even when the higher rate of chemical has been used and spraying carried out at the stage regarded as being most favourable. Further investigations are in progress but it would appear that the corm dormancy factor has been largely responsible. If, for some reason such as water logged conditions, a large proportion of corms do not sprout, poor results necesarily follow. On the other hand, if conditions are such that a

high percentage of the corms produce shoots, an opportunity is created to give the weed a severe check.

Cultivation undoubtedly disturbs dormant corms, and, where practicable, should form part of any control programme. There have been many cases where Cape Tulip has been reduced to very small proportions by several sprayings, only to be followed by a strong growth of the weed after working the land. As already mentioned, burning to destroy surface trash is also helpful.

The Agriculture Protection Board makes 2,4-D ester available at a cheap rate for the control of primary noxious weeds such as Cape Tulip. Two pounds of acid equivalent or active chemical, the usual rate applied per acre for this weed, costs approximately 15s. when the farmer uses his own equipment. When considering the cost, we must take into account the value of additional grazing. Many farmers consider that this more than repays the cost of treatment during the season following application. Again the outlay must be regarded as a debit against the whole property rather than the affected portion for, unless active measures are taken against Cape Tulip when present in relatively small proportions, it will soon become a problem over an extensive area.

ORCHARD REGISTRATION

All orchards are due for registration on July 1, and under the Orchard Registration Regulations a single fruit tree or vine must be registered.

A fee of 2s. is payable—

(a) For an orchard less than 1 acre in area containing 1 to 24 trees and/or vines.
(b) For a nursery of any size.
(c) For an orchard less than 1 acre in area containing 25 or more fruit trees and/or vines under four years old.

A fee of 5s. per acre or part of an acre is payable—

(a) For an orchard containing 25 to 100 fruit trees and/or vines.
(b) For an orchard of one acre or more in area planted with fruit trees and/or vines of four years of age or over.
(c) For a vineyard of one acre or more in area planted with grape vines, the fruit of which is used only for the manufacture of wine. (Maximum fee, £3.)

Householders with one or more backyard trees or vines must register them and pay the registration fee of 2s. **The registrations can now be made for a period of one or five years.**

The Head Office of the Department of Agriculture, St. George's Terrace, is the main centre for the receiving of orchard registration fees and will be open from Mondays to Fridays (9 a.m. to 4 p.m. including lunch hours) to Friday, July 29.

In the Fremantle area, fees may be paid at the Water Supply Office, Market Street, Monday to Friday, from 10 a.m. to 3.30 p.m. to Friday, July 29.

At Midland Junction, fees may be paid at the Clerk of Courts office, Monday to Friday, from 10 a.m. to 3.30 p.m. to Friday, July 29.

In country districts all Clerks of Courts are receivers of fees during the month of July. In addition Departmental Officers will receive registrations at the following centres:—

Kalamunda: District Office, Department of Agriculture, each Friday during month of July, 9 a.m. to 4 p.m.

Harvey: Harvey Irrigation Branch Office on the following days from 9 a.m. to 4 p.m.: Monday, June 27, July 4, 11 and 18; Wednesday, June 29, July 6, 13 and 20; Friday, July 1, 8, 15 and 22.

Waroona: Irrigation Office (Agric. Room), Tuesday, June 28, July 5, 12 and 19.

Brunswick: Road Board Office (2 p.m. to 4 p.m.); Thursday, June 30, July 7, 14 and 21.

Pinjarra: Pinjarra Court House, 10 a.m. to 3.30 p.m., July 1, 8, 15 and 22.

Mandurah: Road Board Office, 9 a.m. to 4 p.m., Monday, June 27, July 4, 11 and 18; Tuesday, June 28, July 5, 12 and 19.

Registration cards may be obtained at Road Board Offices, Police Stations, Clerks of Court and most Post Offices.

SAVE!

BUY TIMBER IN TRUCK LOTS

We'll load a railway truck with salvage timber—in sizes and lengths suitable for barns, sheds, sheep pens, etc.—and rail it to any part of the State.

Write for details and prices to—

STATE BUILDING SUPPLIES

Head Office: 306 Murray Street, Perth. Phone 21 2541

LAMB MARKING

by

I. K. STOTT, B.Sc. (Agric.)

Sheep and Wool Adviser

LAMB marking is the most severe of the various ordeals which sheep are called upon to endure during their lifetimes—yet it is an operation, or rather a series of operations, to which the average flockowner gives but little care and thought.

Castration, ear marking and tail docking of male lambs and ear marking and tail docking of ewe lambs are the steps involved—usually in this order. Inoculation for entero-toxaemia (pulpy kidney) protection and the mules and the tail-strip operations for blowfly protection can also be carried out at the same time.

To minimise the losses that can and do occur, attention to age of lambs at marking, the weather and time of day for the operation, the methods used, and observance of strict hygiene will pay big dividends—which means that there will be fewer lambs lost, less check to lamb growth, quicker healing and fewer lambs crippled.

MARK THEM YOUNG

Marking is best carried out when lambs are three to four weeks of age. The younger the lamb at the time of the operation, the less the check will be. Strong lambs can be marked when they are only a few days old and certainly it should be the aim to mark all the lambs before they are six weeks of age.

With protracted lambings, more than one marking will be necessary—the first when the bulk of the lambs are three to four weeks old and subsequently at intervals according to the drop.

Fat lamb breeders wishing to ensure that their lambs receive the minimum check to growth, may mark at an earlier stage and have more frequent markings.

CHOOSE A MILD DAY

Marking should, if possible be carried out on a mild day. Cold wet days and hot sultry weather are unsuitable. Cold wet days added to the shock of marking can easily cause losses. Blowfly strike is often a problem in hot sultry weather.

TIME OF DAY

Finish early in the day—allowing time for lambs to "mother up" by nightfall.

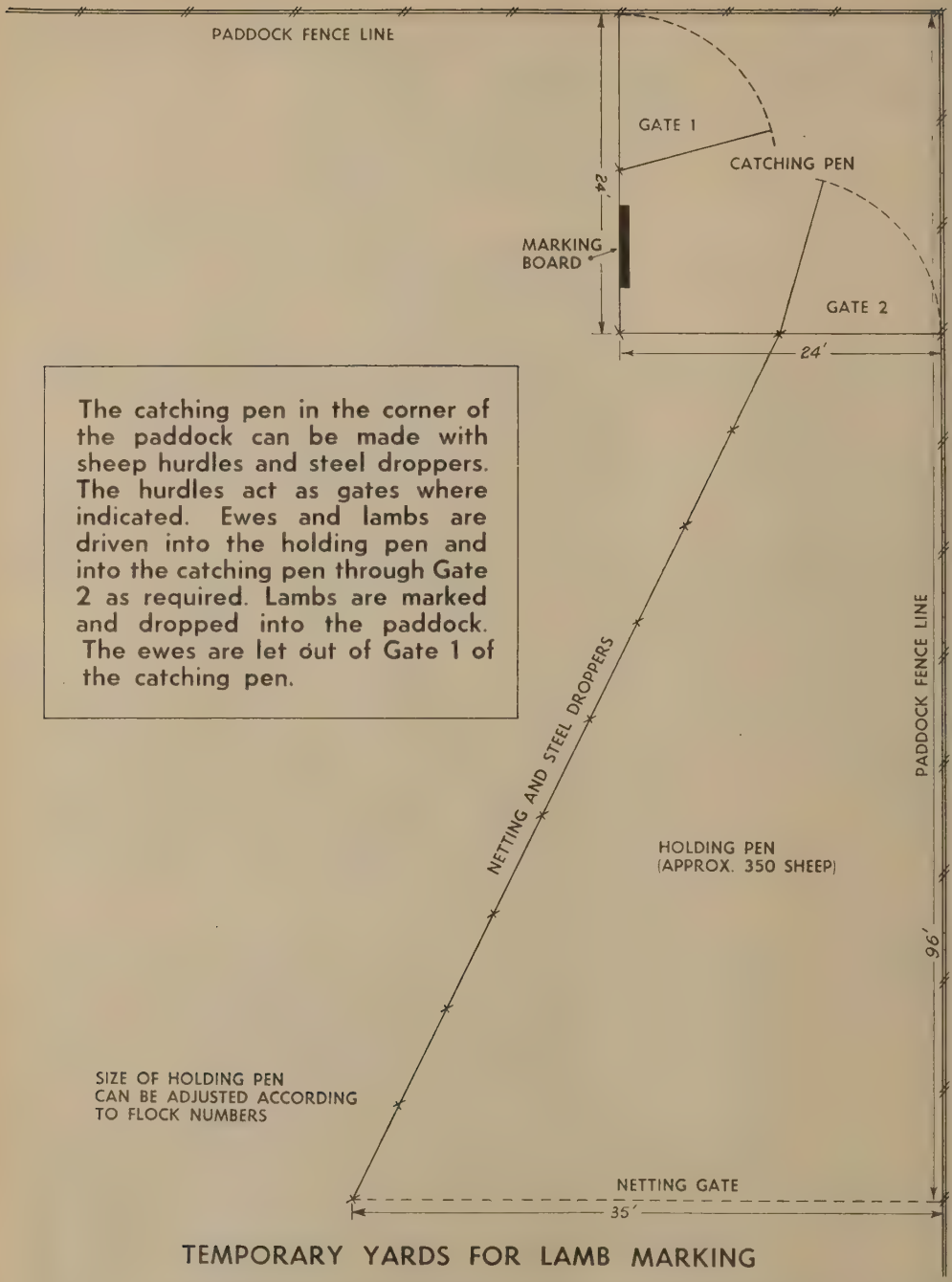
On the day of the operation, the lambs should not be overheated by too much driving. Finishing early—no later than three to four o'clock in the afternoon—will allow lambs and ewes time to sort themselves out and "mother up" before nightfall. Careful shepherding to assist this process is a necessary precaution.

THE SITE

The common diseases of lamb marking, tetanus, arthritis, gangrene, and caseous lymphadenitis (cheesy gland) all result from organisms which abound in soil and droppings around old sheepyards or camps.

Use Temporary Yards

Marking wounds give these organisms an ideal opportunity to attack the lamb. It is therefore highly desirable that marking be carried out away from any source of infection. Temporary yards erected on a new site each year will achieve this at little cost. For preference they should be in the paddock in which the ewes and lambs are running. With the provision of


PADDOCK FENCE LINE
GATE 1
CATCHING PEN
24'
MARKING BOARD
GATE 2
24'
The catching pen in the corner of the paddock can be made with sheep hurdles and steel droppers. The hurdles act as gates where indicated. Ewes and lambs are driven into the holding pen and into the catching pen through Gate 2 as required. Lambs are marked and dropped into the paddock. The ewes are let out of Gate 1 of the catching pen.
NETTING AND STEEL DROPPERS
PADDOCK FENCE LINE
HOLDING PEN
(APPROX. 350 SHEEP)
96'
SIZE OF HOLDING PEN
CAN BE ADJUSTED ACCORDING
TO FLOCK NUMBERS
NETTING GATE
35'

TEMPORARY YARDS FOR LAMB MARKING

Fig. 1—Diagram showing suitable layout for temporary lamb-marking yard

such temporary yards the lambs, once marked can be dropped on to clean ground in the paddock where they are to run with their mothers. Hot dusty driving is avoided and the lambs can soon find their mothers and readily settle down.

If for any reason temporary yards cannot be erected and it is necessary to mark in old permanent yards—cleaning away droppings and refuse, using a new clean marking board, and arranging for lambs to drop on to the grass outside the yards will all help to minimise the risk of infection.

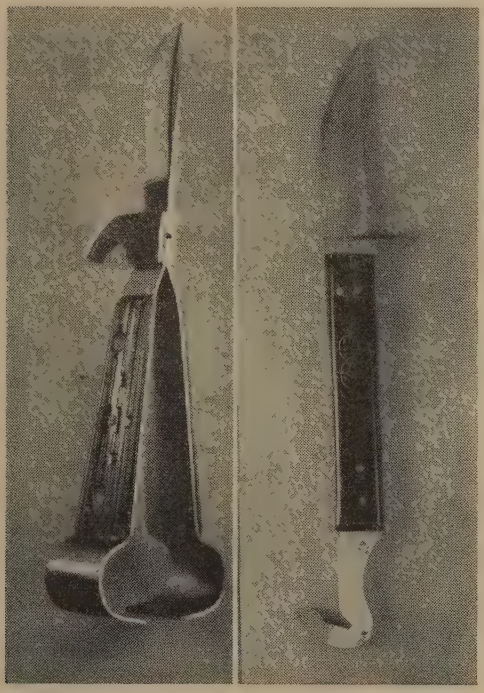


Fig. 2—Two popular types of lamb-marking knives. That on the left hand has a toothed clam for withdrawing the testicles. That on the right has a hook for the same purpose.

CASTRATION

Castration involves very tender tissue—be firm but not rough—quick but not careless.

A knife, elastrator or bloodless emasculator can all be used for castrating lambs.

A good sharp knife is preferred by most operators, as it is quick, sure and effective, resulting in clean wounds which heal rapidly.

Using the knife, the most common method of castrating is to cut off the end of the purse or scrotum ("tipping"), and withdraw the testicles with a hook or toothed grip on the end of the marking knife—some people use their teeth.

An alternative is to slit the purse from side to side ("slitting"), press the testicles through and withdraw them.

"Tipping" allows better drainage of the wound. With "slitting," the advantage is that it allows more cod fat and a slightly better appearance when the wether is fattened for market.

Sometimes one or both testicles are not "let down" and cannot be grasped by the operator for removal—resulting in imperfectly castrated animals—commonly called "stags." Such animals should only have about two inches of their tails removed so that the owner can pick them out and dispose of them at a later date.

Elastration.

Using small strong rubber rings expanded and applied with an instrument called an elastrator, elastration is a bloodless method of castrating or tailing. It uses the principle of restricting the blood supply to the scrotum or tail so that they eventually wither and drop off.

In castration the ring is applied between the scrotum and the body, cutting off the blood supply to the scrotum, and eventually causing it to wither and fall off.

Emasculators.

Bloodless emasculators of various types are sometimes used for treating lambs without cutting the scrotum. These use the principle of crushing the cords leading from the testicles and so rendering the animal sterile. They have the advantage that they cause less shock and lessen risk of disease and flystrike but they are slower to operate, and unless used carefully may result in a percentage of "stags" or imperfectly castrated animals. The instrument is in the form of blunt-nosed pincers which crush the spermatic cords without breaking the skin of the scrotum or purse.

Fig. 3—The instrument used for expanding the rubber rings used for elastration

EAR MARKING

Use sharp, well set pliers.

Mark ewes on the right or off ear.

Mark males on the left or near ear.

Special pliers with the owner's registered ear mark are used for this part of marking. Ewes are marked on the right ear and wethers and rams on the left. A quick sure movement is used. It is an offence to put any other mark on the registered ear other than the registered ear mark.

(Note.—Inquiries about registered ear marks should be directed to the Registrar of Brands, Department of Agriculture, Perth.)

Ear Age Marks.

These are not compulsory, but if applied, the six-year cycle in the ear opposite the registered mark must be used.

In addition to the registered ear mark a system of distinctive ear age marks is used by some owners.

Owners desiring to age-mark must conform to the provisions of the Brand Act which states that "in every sixth year after 1905 the off or near ear, as the case may be, of all sheep lambed during the year shall be left clean; for every sixth year after 1906, the age mark shall consist of one notch on the front of the ear; for sheep lambed every sixth year after 1907 the age mark shall consist of two notches on the front of the ear; for sheep lambed every sixth year after 1908 the age mark shall consist of three notches in the front

Fig. 4—The bloodless emasculator used for crushing the spermatic cords

of the ear, for sheep lambed every sixth year after 1909, the age mark shall consist of one notch in the back of the ear; for sheep lambed every sixth year after 1910 the age mark shall consist of two notches on the back of the ear."

Table Showing Years for Age Marks

Clean	1959	1965	1971
One notch front	1960	1966	1972
Two notches front	1961	1967	1973
Three notches front	1962	1968	1974
One notch back	1963	1969	1975
Two notches back	1964	1970	1976

DOCKING

Cutting tails level with the tip of the vulva (and equivalent in wethers) is the correct tail length and the beginning of blowfly control.

Tailing or docking may be done with the knife, elastrator or searing-iron. As for castration, the knife is generally considered the most satisfactory method.

The method of cutting and the tail length are of vital importance in the future life of the sheep. Trials have been shown that, for prevention of crutch and tail strikes, cutting the tail level with the tip of the vulva in ewes and the equivalent length in wethers is the beginning of maximum fly control. (The mules operation and tail strip at lamb marking or later in the sheep's life completes the protection). The reason for the importance of tail length is that the correct length tail helps to keep dry the bare area around the vulva. A tail of the right length parts the wool around the vulva keeping it away from urine moisture. In addition it can sweep across the vulva in a sideways movement drying the bare area after the ewe has urinated. Short tails cannot do this and crutch strikes are worse in sheep with tails cut this way than in any other. Overlong tails tend to collect moisture and become daggy and provide ideal sites for fly-strike.

In the case of wethers the medium tail length allows the tail to be correctly tail-stripped when this operation is carried out.

DIAGRAM SHOWING SIX-YEAR EAR AGE-MARKING CYCLE

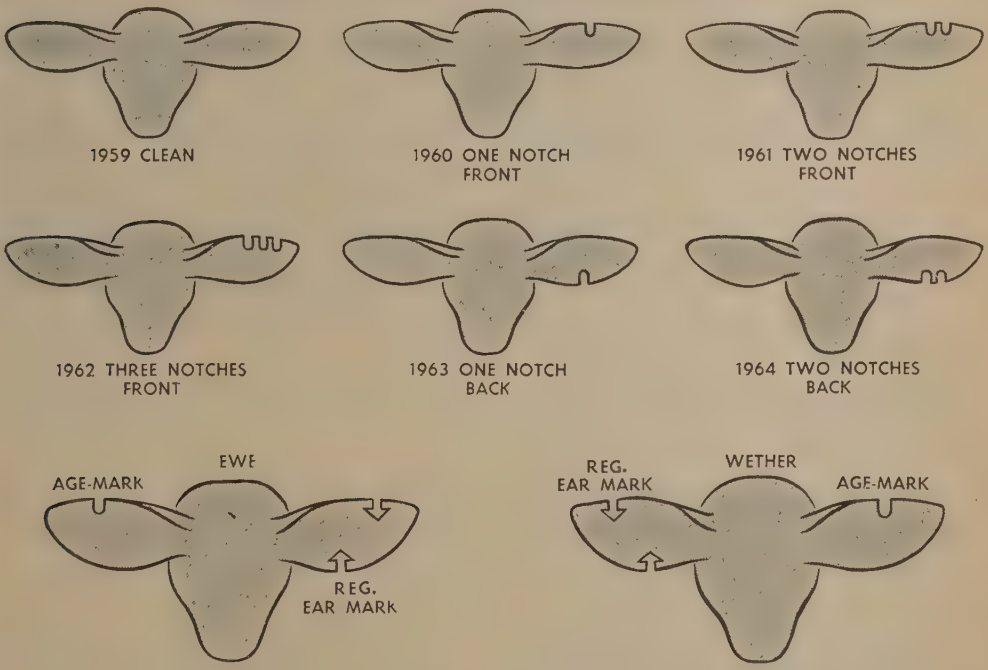


DIAGRAM SHOWING SHEEP CORRECTLY EAR MARKED AND AGE MARKED FOR 1960

Fig. 5—Diagram showing method of age-marking sheep

In cutting the tail, place the knife edge ½ in. below where the cut will be made. Push the loose skin up to the correct level. Fold the tail over with the tip pointing towards the brisket and make the cut.

Cutting in this way allows a flap of loose skin to heal upwards over the severed stump of the tail further increasing blowfly protection as there is no wool-bearing skin left near the vulva to become soiled with urine and so attract flies.

Tail length and method of cutting are of great importance—this part of marking is best left to careful and reliable workers.

If the sheep blowfly is active however, a dressing may be applied to the wool on the tail and around the crutch and around the Scrotum of wethers.

HYGIENE

Use sharp tools and be clean at all times.

It should always be remembered that in lamb marking tender sensitive tissue is being exposed. Strict hygiene is a **must.**

Operators and instruments should be as clean as possible at all times. Boil the instruments for five minutes before commencing the day's marking and keep them in a tin of antiseptice between successive lambs.

Fig. 6—Photograph showing correct method of tailing a lamb

It is usual to place ewe and wether tails in separate heaps and so obtain a tally of lambs marked according to sexes.

Note.—In using the elastration method for removing tails the ring should be placed ½ in. lower down the tail than the required length. This allows for shrinkage of the tissues when the tail drops off and the final result is a tail removed level with the tip of the vulva.

AFTER-TREATMENT

No dressing or after treatment is generally needed if marking is done under clean conditions in temporary yards. The wounds heal quicker and better if left alone.

In using the knife keep it sharp as this gives a clean wound. Blunt instruments slow down the work and bruise off rather than cut off—bruised areas take longer to heal. Remember that although quickness in making clean cuts is desirable, breaking records at lamb marking should not be the aim.

DISEASES FOLLOWING LAMB MARKING

For a discussion of diseases that may follow upon lamb marking see Departmental Bulletin No. 2651 or pages 395-401 of the July-August, 1959 issue of *"The Journal of Agriculture."*

● **BROWN SPOT IS A SERIOUS FUNGUS DISEASE OF PASSION FRUIT IN THIS STATE. SUCCESSFUL CROP PRODUCTION IS DEPENDENT ON ADEQUATE DISEASE CONTROL IN THE PLANTATION.**

BROWN SPOT OF PASSION FRUIT

By the PLANT PATHOLOGY BRANCH

BROWN SPOT caused by the fungus *Alternaria passiflorae*, is found in plantings throughout Western Australia. Severe outbreaks of the disease have occurred in most districts, including Serpentine, Manjimup, Nannup and Denmark. Although isolated young plantings may remain healthy for two or three years the disease eventually becomes established in the vines.

SYMPTOMS

The fungus may attack all above-ground parts of the vine.

On leaves the disease becomes evident as circular brown spots which enlarge under favourable conditions and later develop lighter coloured central areas (Fig. 1). Badly affected leaves fall readily and a severe outbreak of the disease may defoliate vines.

Laterals develop dark brown marks or lesions which may reach several inches in length (Fig. 2). The lesions often encircle the laterals and cut off the sap flow with resulting death of all parts beyond. Sudden wilting of fruit on a recently cinctured lateral is an obvious symptom by which the disease can be detected (Fig. 3.)

The fungus also attacks the fruit which develops brown sunken spots more or less circular in outline (Fig. 4.)

SPREAD OF DISEASE

The brown spot fungus is spread by means of minute spores or fungal seeds which are produced in large numbers on diseased plant parts. These spores are carried by wind or splashed by rain on to healthy leaves, laterals and fruit where they germinate and cause new infections.

Warm, moist weather conditions favour brown spot development and so in normal seasons the disease is most serious during the spring and early summer.

Unpruned vines are very subject to serious brown spot attack. The tangled growth of foliage and laterals remains wet for long periods after rain and provides ideal conditions for disease development.

CONTROL MEASURES

Successful control of brown spot depends on the adoption of two routine practices—pruning and spraying.

Fig. 1—Passion vine leaves infected with Brown Spot

Pruning.

An appropriate method of pruning the vines is necessary at least once a year to prevent the growth becoming too dense on the trellis. Pruned vines dry out more readily after rain and also allow of better penetration and coverage by fungicidal sprays.

Basically the pruning system consists of trimming off all low hanging growth and systematic thinning out of laterals. Any diseased growth should be removed and all prunings burnt.

Fig. 2.—Passion vine lateral recently cinctured by the Brown Spot fungus (at point indicated by arrow). Death of all distal portions of the lateral will ultimately occur

Fig. 3—Wilting of fruit on a cinctured lateral is a symptom by which Brown Spot can be easily detected. The affected lateral may have to be traced back several feet before the causal lesion is discovered.

Details concerning pruning methods are given in Bulletin No. 2018 entitled "The Passion Fruit" and published by this Department.

Spraying.

Immediately after pruning spray the vines with Bordeaux mixture at 4-4-50 strength plus a suitable spreader such as calcium caseinate.

Routine sprays should also be applied at monthly intervals during spring and early summer, and at two monthly intervals thereafter.

During spring, the intervals between spray applications should be reduced to 14 days whenever weather conditions are extremely favourable to brown spot development.

Bordeaux mixture should not be applied to the vines for a few weeks prior to harvesting otherwise an unsightly spray deposit will be left on the fruit. To overcome this problem one of the newer organic fungicides such as Zineb or Ziram should be substituted in the spray programme at that time.

Fig. 4—Fruit attacked by Brown Spot

What's Wrong With That Plant?

By the PLANT PATHOLOGY BRANCH

EACH year several thousand inquiries are received from people who want to know "What's wrong with that plant?" The plants range from common fruit, vegetable and pasture plants to rare ornamentals. In most cases, the inquiries can be answered satisfactorily by Departmental officers who specialise in the study of various plant troubles.

However, it is not always possible to give helpful information particularly with postal inquiries. In many instances, the specimen is unsuitable for examination and in other cases, insufficient information is given for the correct diagnosis of a non-parasitic disorder.

Among the most unsatisfactory specimens are fruits that have collapsed to a rotten pulp in transit, and foliage which has completely shrivelled and dried before arrival. Occasionally there is the extreme case when someone cuts out spots from leaves and forwards them with a covering note asking us to "please advise how to cure these spots"! We are most anxious to be of assistance in all plant disease problems, but there are golden rules, which should be observed when forwarding specimens by post.

These are—:

1. Send a letter telling us the story.

In the letter don't forget to tell us the name of the plant, the changes you have seen in it and the conditions under which it is growing. This all helps us to assist you, because sometimes a "disease" is not caused by organisms, but is associated with unsuitable growing conditions or else with an injury of some kind.

2. Send the whole plant including the roots (if possible).

This is not to say that a large lemon tree, for example, should be submitted after its first few years. However, there are root diseases which cause symptoms in the foliage. It is necessary to examine the roots of such plants to determine the nature of the disease.

3. Send suitable material.

Choose material that has typical symptoms, and which will keep in transit. The method of package will vary with the type of specimen. For instance, leaves should be flattened and placed between layers of thick paper or cardboard, whereas cereals may be packaged satisfactorily, merely by rolling in several sheets of newspaper. Fruits and pasture sods travel best when enclosed in a stout cardbord box, whilst roots, with soil adhering, should be sent in a plastic bag. However, when forwarding a complete plant, only enclose the roots in plastic and wrap the remainder in newspaper. In the dry summer months, the freshness of specimens may be maintained in transit by using moist newspaper for the inner wrappings. This is inadvisable in the cooler months as the moisture will encourage secondary moulds.

Try also to avoid having the specimen arrive during the weekend.

4. Address your inquiry correctly.

Send both your letter and specimen directly to:—

The Superintendent,
Division of Biological Services,
Department of Agriculture,
Jarrah Road,
South Perth.

The inquiry will be passed on immediately to the specialist who is most capable of assisting you with your problem.

INSECT PESTS

SNAILS AND SLUGS

By C. F. H. JENKINS, M.A., Government Entomologist

WHILE snails and slugs are not insects, they have been included in this series of articles, because the damage they cause is very similar to that caused by insect pests—and furthermore, the task of testing and recommending control measures is usually left to the entomologists.

The commonest species of snails in this State are the Brown or English snail (*Helix aspersa* (Müller)) and the White or Italian snail (*Theba pisana* (Müller)).

Two other introduced species which may also be found associated with cultivated plants are the Dune snail (*Cochlicella acuta*) and the Cellar snail (*Hellicella cellaria)*. The Dune snail is a small sharply-spired species with habits somewhat similar to the White snail but it is much less common and up to the present has proved of little economic importance. The Cellar snail looks somewhat like a very small and delicately-shelled Brown snail. It is found in lawns, sheltered situations and sometimes occurs on greenhouse plants but the damage done is seldom serious.

Slugs may be roughly described as snails without shells and as the habits and control measures described for snails will apply in the main essentials to slugs, they need receive no further mention.

The Brown snail reached this country many years ago, and is now practically world-wide in its distribution. The first record for Australia came from New South Wales in 1888, but the exact date of its arrival in Western Australia is not known. The White snail is a later arrival in this State and is believed to have been transported in ships' ballast from South Africa, where it is a well-known pest. Bunbury and Albany contend for the doubtful honour of being the first site where this snail was established locally. Its distribution at present is essentially coastal, and in situations where it is firmly established it far outnumbers the larger brown snail. So alarming was the rate of increase of this snail in portions of California that an extermination campaign was undertaken in 1922 and the results were eminently successful.

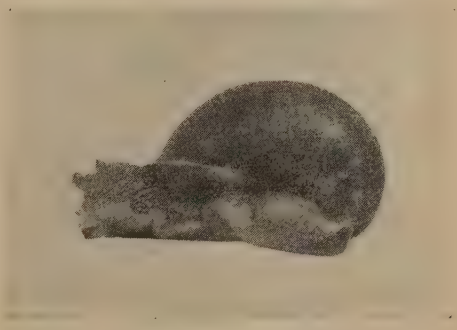


Fig. 1—Brown or English snail (natural size)

The Brown snail is the larger of the two species, the full-grown shell being formed of from four to four and a half whorls or coils and measuring an inch or more in diameter. The shell of the White snail may attain a diameter of from a half to three-quarters of an inch.

The food of the small snail consists both of living plants and dead or decayed vegetation, and they also show cannibalistic tendencies if any of their squashed

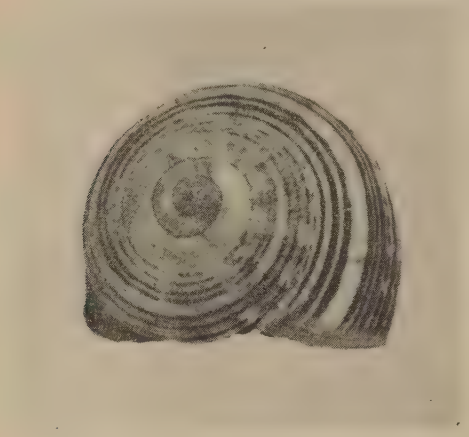


Fig. 2—White or Italian snail (about 2½ times natural size)

brethren are available. The snail has no true jaws, but rasps its food by means of a tongue-like structure or radula covered with teeth like a file, the suitability of which for disposing of vegetable material few gardeners will question.

HABITS

The nocturnal habits of the Brown snails are well-known to all who have surveyed with dismay their surviving seedlings on "the morning after the night before." The White snail is not so retiring in its habits and may be found feeding in the daytime.

The liking of snails for moisture and shelter is also general knowledge, and should be remembered when attempting control measures. Masses of weeds and tangles of creepers against walls and fences often provide harbourage for snails.

During adverse weather conditions, either dry or cold, the snail becomes inactive and seals off the entrance of its shell with a kind of diaphragm. Under our summer conditions this prevents excessive loss of moisture and enables the creature to survive even when exposed in clusters on twigs and fences.

When this feature of the snails' habits is remembered there need be no astonishment at the sudden appearance, apparently from nowhere, of armies of snails immediately following the first autumn rains.

Experiments in South Africa showed that out of 50 snails of both species collected in January, 1919, and placed in jars of soil without food or artificial moisture six Brown and three White snails revived and fed on cabbage leaves at the end of March, 1921. That is after a dormant period of over two years.

When the shell of the snail becomes injured it can be repaired to a remarkable degree. New shell will be built over the places where sections have become detached, but the original markings are not reproduced, so that the repair work will always remain apparent.

At this stage perhaps it is appropriate to mention that, contrary to a rather popular belief, when a snail has been thoroughly squashed it is not able to survive, neither can any eggs it may contain continue to develop.

LIFE HISTORY

There is no differentiation of the sexes in snails, as each individual possesses the male and female organs, and so may be referred to as an hermaphrodite. During mating, mutual fertilisation takes place and both individuals may lay eggs. A suitable spot is selected in a damp, sheltered situation, and a hole about an inch or more in depth is dug. The eggs are coated with a slimy mucilage which causes them to cling together and swell when moistened. A single snail may lay a number of times and produce several hundred eggs. On hatching, the young snails are furnished with tiny white shells, and feed gregariously for some time, but when a few months old they lead a more individualistic life. The period required for the eggs to hatch is about a fortnight under good conditions, but this period may be greatly increased by dryness or excessive cold. The rate of growth is relatively slow, for it takes over a year for the full size to be reached.

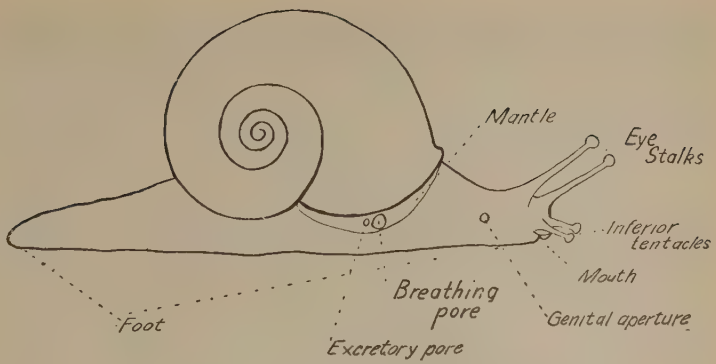


Fig. 3—Diagram of snail

CONTROL

Baits.—Metaldehyde mixed with bran has proved one of the most effective slug and snail baits yet devised. The poison may be obtained as a powder and sometimes also in the form of tablets sold under the name of "meta" fuel and used in "tommy's cookers." Calcium arsenate or BHC is frequently recommended as an addition to snail bait to ensure that no individuals recover from the paralysing effect of the metaldehyde.

The recommended formulas are:—

Small Quantity—

Metaldehyde	½ oz.
Bran or Pollard	1 lb.
Calcium Arsenate	1 oz.
or	
10 per cent. B.H.C. (Benzene-hexachloride)	½ oz.

Large Quantity—

Metaldehyde	1 lb.
Bran or Pollard	30 lb.
Calcium Arsenate	2 lb.
or	
10 per cent. B.H.C.	1 lb.

Cement Blocks.

In addition to the normal type of snail bait one of a much more permanent nature has recently been developed. The constituents are as follows:—

Metaldehyde powder—1 part by volume
Rice bran—3 parts by volume
Hydrated lime—1 part by volume
Cement—3 parts by volume

These ingredients should be mixed dry and water added to make a thick creamy mash and then allowed to set thoroughly in a shallow pan. Break up into blocks about 2 in. square by about ¾ in. thick and place where snails appear in the early evening. If rice bran is not available, poultry mash may be substituted with good results.

The cement blocks should be collected up when weather conditions are unsuitable for snail activity and re-distributed. If the blocks are left out permanently during the winter they should be placed in small flower pots or tins and placed on their sides to protect the bait from heavy rains.

The baits should be thoroughly mixed and may be broadcast over the affected area or placed in small heaps near plants to be protected. The metaldehyde may burn some foliage and should not be

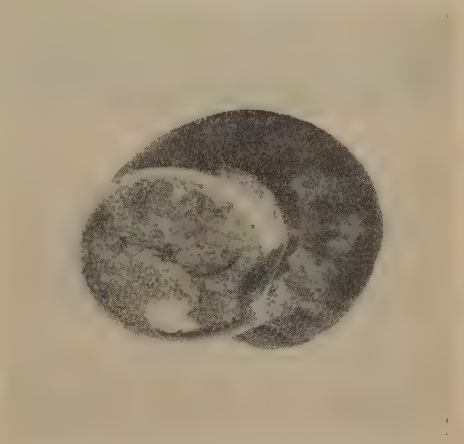


Fig. 4—Brown snail showing seal across shell during the over-summering or aestivating period

Fig. 5 — Over-summering White snails clustered on a small bush at Spearwood

liberally sprinkled on young seedlings. The addition of a small quantity of water to bran baits is sometimes adopted, but would be undesirable in pollard mixtures.

Where metaldehyde cannot be procured, the use of baits containing bran and calcium arsenate or even Paris green will give helpful results. The addition of two tablespoonsful of honey or treacle to the pound of bran is recommended, and a small quantity of water should also be added to make a free crumbling mash.

In dry weather the garden should be thoroughly watered early in the evening before any bait is distributed. This will stimulate snail activity and greatly improve the kill.

Dusts.

Slaked lime is widely recommended for use against snails and slugs, but its efficiency leaves much to be desired. The addition of powdered copper sulphate (bluestone) or copper carbonate to the lime, however, makes a very toxic dust. This cannot be recommended for the actual treatment of plants, but where a plot of ground is endangered by invasions

of snails from adjacent breeding grounds, a barrier of lime and copper dust will be found invaluable. Should the creatures succeed in crossing the barrier they will succumb very rapidly. The formula recommended is:—Copper sulphate or copper carbonate, 1 part; slaked lime, 12 parts. The efficiency of this mixture unfortunately deteriorates once the dust has become caked from wetting.

Sprays.

Copper sprays are particularly toxic to slugs and snails but as they may also burn plant foliage their use in a crude form can only be recommended on non-cultivated areas.

Bordeaux mixture on the other hand can be safely applied to most plants and a mixture widely favoured is 4 lb. of lime, 4 lb. of bluestone and 50 gallons of water. The addition of 1 gallon of white spraying oil and ½ pint of Black Leaf 40 or Nicotine Sulphate to the above mixture will increase the efficiency of the spray where quick results are required.

Home gardeners wishing to try sprays may, of course, make proportional reductions to the above amounts recommended for commercial growers.

Cultural Methods.

The importance of clean cultural methods cannot be over-emphasised in the control of slugs and snails. Weed growth, hedges and accumulations of litter are favourable to snail activity and should be dealt with appropriately.

In the case of the White snail particularly, action during the summer may considerably lessen the damage to be experienced the following winter. The fact that the snails cluster on grass, weeds and shrubs during the dry months renders them very susceptible to fire and judicious burning off in paddocks and along roadsides may almost eliminate the danger of invasions when autumn rains commence. Where wholesale burning is not possible a break between "snail country" and cultivated plants should be made either by burning or cultivating. This will establish a bare strip over which the invading snails must pass and one which may be periodically treated with bait or spray whenever snail activity is noted.

MURESK AGRICULTURAL COLLEGE

(Department of Agriculture)

Parents are reminded that applications for 1962 admission to Muresk Agricultural College close on December 31 of this year. A preliminary selection of 1962 entrants is made after the Junior results are available early in 1961.

The successful applicants then continue with Sub-Leaving, or higher studies, in 1961.

Before the course can be commenced students must have attained:—

(a) Sub-Leaving Standard in English, Maths. A, Chemistry and Physics (including Magnetism and Electricity).

(b) Junior Standard Bookkeeping.

Should places still exist for 1962 commencement after the preliminary selection early in 1961, they are filled in order of application during 1961, by qualified applicants.

Duration of Course.—Two years.

Fees.—Approximately £180 per annum covering full residential charges.

Scholarships.—Department of Agriculture (3), the "Countryman," and J. J. Poynton Memorial (2).

Boarding Allowance.—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

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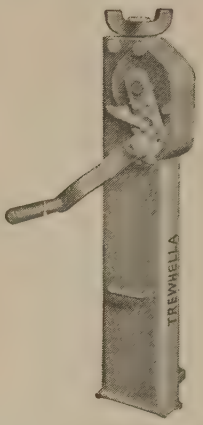

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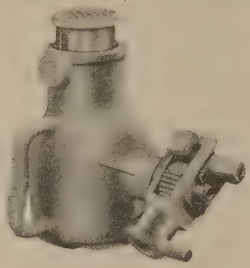

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HELP THOSE LAMBS TO LIVE

By C. J. SPENCER, B.Sc. (Agric.), Sheep and Wool Adviser, Katanning

IN almost all breeding flocks the most serious stage of sheep loss is from birth to three days of age with the majority of these losses occurring at birth or during the first day. The number of lambs lost at this time is rarely known, but survey work shows that on most properties ten to twenty of every hundred lambs born are dead before three days of age. The economic importance of such losses cannot be emphasised too much. Money has been expended for rams as sires, while the ewes have received extra feed and have had their wool production checked by the developing lamb. It must also be remembered that lamb losses mean less surplus sheep for sale, lower culling levels and result in slower flock improvement.

Field observations and research work show the three main lamb-killers to be lack of adequate feed, exposure to either cold or heat and vermin such as foxes, dingoes and eagles.

Feed.—The importance of feeding the ewe correctly to ensure a healthy lamb and an early flow of milk has been stressed in an earlier article (ref. J. Dept. Agric. W. Aust., June, 1960), where the need for adequate good quality feed in the last third of pregnancy was stressed.

Exposure.—While exposure to either severe hot or cold conditions can kill lambs, cold windy weather is by far the more serious in the agricultural areas of Western Australia. These losses are often due partly to the effect of the cold on the lambs and partly to desertion by the ewes as they are less likely to mother their lambs when weather conditions are severe.

Vermin.—The importance of vermin varies not only from district to district but also with the strength of the ewes and lambs at lambing time. Efforts to reduce the vermin population need to be made before lambing commences. For those areas where foxes are a serious problem, the erection of a fox-proof fence should be considered as it is the surest protection for the lambs.

MAKING A FENCE FOX-PROOF

The fence described and pictured here has proved very effective on the West Narrogin property of R. Shepherd who constructed it by adding to an existing rabbit-proof fence. Comparative lambing results for one year showed that in the autumn an extra eight lambs for every hundred ewes mated were marked for ewes lambing inside the fence as against those

lambing outside. On the other hand no advantage was seen for spring lambing, indicating that either the foxes were less troublesome or that the ewes were better mothers at that time of the year.

The essential features of the fence are that it has an outward slope at the top and that both the top and bottom are netted. Cunning though he may be, the fox goes to the base of the fence before attempting to jump or climb and so is blocked by the sloped section.

MATERIALS USED

One extra post to every three in the original fence was used as support for the upper netting. These need not be as thick as normal fence posts and actually those that are just too thin for normal use are quite suitable. These posts were wired to the normal fence posts as shown (see illustration) and sheep netting joined to them above the original fence.

No extra plain wire was used as the two original top wires of the fence were used above and below the sheep netting. In this way the only extra materials used are about 150 small posts to the mile plus sheep netting.

The fence described has a total height of six feet with the upper part projecting out eighteen inches from the base.

RESERVE THE PADDOCK FOR LAMBING

A fox-proof paddock should be reserved for lambing time so that the ewes can be grouped together. This must eventually interfere with the cropping programme unless the paddock is set aside exclusively for lambing or unless a very large area, involving a number of paddocks is included inside the fox-proof fence. If this is done, part of the area can be cropped while the balance is used for lambing. Such a project will however involve a considerable outlay as the extra materials required to convert an existing netting fence into a fox-proof fence would cost about £450 to enclose an area of 600 acres.

RESEARCH RESULTS

In an attempt to measure more accurately what happens to the newborn lamb, research workers have compared lambs under different conditions.

In one trial a flock of poorly-fed ewes was split into two groups. One group was allowed to lamb under field conditions and

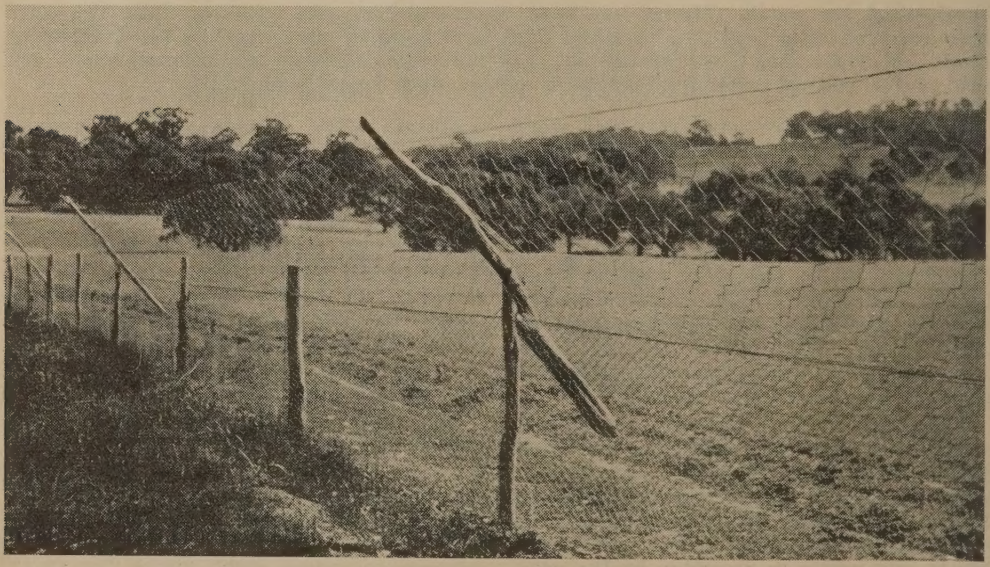

Fig. 1—A rabbit-proof fence made fox-proof. Long thin posts are wired to the tops of each third fence-post to carry sheep-netting. Wire struts from the tops and bottoms of the thin posts keep the fence rigid, and two plain wires support the sheep-netting

here 21 lambs died before three days of age. The other group was assisted during lambing, the lambs kept in a warm shed for three days during lambing and where necessary artificially fed. Only one lamb was lost.

	Paddock Group.	Housed Group.
Died at birth	6	0
Died by three days	15	1
Total lamb losses	21	1

Fig. 2—Close-up of one of the posts supporting the sheep-netting

In another trial the body temperatures were measured of lambs that had not received milk and were kept in cold conditions. This was aimed at seeing just how the lambs reacted to this type of situation which often occurs in the field. If is to survive, the newborn lamb must produce enough body heat to offset the loss from evaporation while drying. It was seen in the trial that lambs born of well-fed ewes were better able to produce this extra heat than lambs born of ewes that had lost weight in late pregnancy. It was also noted that wind increased the need for extra heat production and so lowered the lambs' chance of survival.

Normally the body temperature of the lamb drops at birth and then rises again within a few hours, but some lambs are unable to produce this extra heat so that their body temperatures continue to fall and they eventually die. This initial temperature drop was more pronounced in the lighter lambs of the trial than the heavier ones so that under these conditions of insufficient milk plus cold their chance of survival was less.

WHY DO LIGHT LAMBS DIE?

The light lamb unfortunately is not just a small lamb as often it is just as long and as tall as the heavier ones. The difference is more in the relative amounts of each tissue, the bone developing in advance of the muscle and the fat forming even later. Also, as with older sheep, the first part

Fig. 3—Another type of fox-proof fence in which the sheep-netting is carried on metal supports secured to the tops of the fence-posts

to suffer in times of feed shortage is the fat and then the muscle, but very rarely the bone.

Because of this the light lamb is largely skin and bone and so it follows that the body reserves are low and the ability to withstand harsh conditions reduced. Field observations show that although they reach the udder, many of these lambs are too weak to suck successfully and soon die.

POINTS FOR THE FIELD

While it is not possible to house lambs at birth, the value can be seen of using sheltered paddocks to lessen the effects of wind, particularly when weather conditions are severe.

When choosing a time for lambing, expected weather conditions should be considered. Cold windy weather lessens the lamb's chances of survival and severe wind and rain, particularly when experienced together, increase the chance of ewes deserting their lambs.

Extremely hot conditions, though less likely to be important in the agricultural areas of Western Australia, can also cause losses through exhaustion.

The well-fed ewe in addition to bearing a strong lamb and providing an early flow of milk, will mother and protect her lamb more readily.

Where foxes are a problem the value of a fox-proof fence as a long-term investment should be balanced against the cost.

Twice daily, or even once daily, inspection of flocks during lambing to assist those ewes having difficulty in lambing will mean more lambs marked. This should be done quietly otherwise other ewes that have just lambed may desert their lambs.

The newborn lamb sucks by instinct and so clearing the udder of wool will help. When crutching the ewes prior to lambing, a blow should be taken in front of the udder to remove this wool.

If the lambs lost during the lambing period are removed and a tally kept, owners will know just how serious this problem is for their particular flocks.

Above all remember that the most crucial time in a sheep's life is the day it is born. To keep it alive then means more sheep for a negligible outlay.

FARMERS

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